Vol. 33 July, 1939 No. 1

QUARTERLY

OF THE

National Fire Protection Association

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $10.

Entered as second-class matter December 15, 1923, at the Post Office at Boston, Mass., under act of March 3, 1879.

60 BATTERYMARCH STREET, BOSTON, MASS.

Application Blank for Associate Membership

Associate Membership is open to any Society, Firm, Corporation or Individual interested in the protection of life and property against loss by fire. Persons in every walk of life are members.

National Fire Protection Association

INTERNATIONAL

Organized 1896

EXECUTIVE OFFICE: 60 BATTERYMARCH STREET, BOSTON, MASSACHUSETTS

All the valuable engineering and popular literature issued by the Association is sent, as issued, to every member.

We furnish free to members the Regulations issued by the National Board of Fire Underwriters, and the lists of devices and materials inspected by Underwriters' Laboratories, Inc.

The Association is the clearing house for all the authoritative information on Fire Protection and Prevention and members are privileged to submit to it their individual problems for solution.

PUBLICATIONS

Quarterly Magazine of the Association. A chronicle of the Association's activities, with valuable contributions of articles on fire prevention and protection and special hazards, and compilations of fire statistics on various classes of property.

News Letter. A special monthly bulletin of timely information on fire prevention and kindred subjects.

Proceedings of Annual Meeting. Containing stenographic report of transactions of the Association and the discussions incident to the adoption of its standards.

Special reports, bulletins, etc., issued frequently during the year.

Year-book and directory. Complete list of members with addresses.

Index to all subjects covered in the Printed Records.

NATIONAL FIRE PROTECTION ASSOCIATION,
60 Batterymarch Street, Boston, Mass.

Please enroll me (or us) as an associate member, and forward the publications to which members elected this month are entitled. I transmit herewith $10.00 as my annual membership dues, which includes a year's subscription to the "Quarterly" of the National Fire Protection Association.

Name.....

Business Connection.....

Street and Number.....

City and State.....

Membership year begins with date of election.

$10 per year dues is the total expense.

No initiation fee, no further assessments.

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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

The Roger Williams Manor, Cranston, R. I., after an early morning fire on June 18, 1939 took three lives and injured many other occupants. This modern appearing, brick-joisted forty-nine apartment building had exit facilities in excess of the requirements of the N.F.P.A. Building Exits Code. Five masonry stair towers led to six exits, but when fire started in a third floor apartment non-automatic fire doors at each stair tower entrance were fastened open. There were no automatic sprinklers, no fire alarm equipment, no standpipe system and no extinguishers except glass bulb grenades in the corridors.

The Quarterly

Vol. 33 July, 1939 No. 1

The New N.F.P.A. Administration. The Board of Directors, as reported in the minutes published in this QUARTERLY, has appointed Percy Bugbee as General Manager. This change is in accordance with Franklin Wentworth's request that he be relieved of his executive duties as Managing Director. It involves no break in the Association policy or Executive Office administration, for Mr. Bugbee as Assistant Managing Director has been working in the closest of harmony with Managing Director Wentworth. Mr. Bugbee has been with the executive staff of the Association since 1921, and responsible for the N.F.P.A. Field Engineering Service since its inception in 1924. Other members of the staff remain without change, several having fifteen to twenty years' experience under Mr. Wentworth's inspiring leadership.

Mr. Wentworth is not retiring in the usual sense of the term. His active and devoted interest in N.F.P.A. affairs continues. In a consulting capacity he will continue in the service of the Association in various non-executive matters in which he is personally interested, and will continue to give freely of his time and experience for the promotion of the cause which has so long been his life work.

Another change is deserving of special mention. Florence S. Osborn, Chief Clerk in the Executive Office, who has been associated with Mr. Wentworth since he became Secretary-Treasurer thirty years ago, retired on July 1 and is succeeded by Ruth A. Freeman, capable Assistant Chief Clerk, who has been working with Miss Osborn for some twenty years. Miss Osborn's conscientious work, dating from the early days when she and Mr. Wentworth constituted the entire office staff, has contributed largely to the efficient operation of the N.F.P.A. office and the service rendered members.

* * * * *

Fire Doors Open Again. The Cranston, R. I., fire pictured in the frontispiece of this QUARTERLY is a typical example of the results of the almost universal practice in apartment, hotel and office buildings of blocking fire doors open. There were many faults in this building which contributed to seriousness of the fire, but if the fire doors on the stairway enclosures on the floor where the fire started had been closed instead of fastened

open, it seems clear that the spread of the fire would have been retarded and the fire department might have been able to save at least part of the lives that were lost. If the fire had started in the basement, where the stair enclosure fire doors had been removed altogether, the casualties would probably have been far greater.

Any inspector in any North American city can find similar conditions in modern residential buildings, which unless sprinklered or otherwise protected are little or no better than the old type of open stairway fire traps, once the stair shaft fire doors are blocked open or removed. Such conditions, so generally found, are clearly not due to deliberate flouting of fire-safety; they are simply due to lack of knowledge of the function of such doors. It is inconceivable that doors would be so generally found fastened open if the occupants of buildings had any understanding of the protection of vertical openings against fire and smoke.

* * * * *

Personal Responsibility vs. Devices. The European method of fire control lies largely in fire prevention, in a well-established habit of care, and in personal responsibility for preventable fire. In the United States and Canada we place greater emphasis upon mechanical provisions for fire safety and less upon the human element, finding it far simpler to provide some automatic mechanical device than to educate all the people who may enter some individual building.

The European method of fire control occasionally fails, with disastrous consequences, when there is some failure of the human element and no mechanical protection is ready to offset the human failure. The North American method fails all too often when the personal element negatives the mechanical protection, as when fire doors are blocked open or automatic sprinkler valves are shut.

There is much that each could learn from the other. The human element in fire safety, the sense of personal responsibility, calls for far more attention than it has heretofore received on this side of the Atlantic. More and better organization is needed, as so well indicated in Mr. Halpin's paper, "The Personal Element in Fire Loss Prevention," which appears in the *Proceedings*, printed as Part II of this QUARTERLY. Better establishment of the legal principle of personal responsibility for negligent acts that may cause fires, endangering life and property, is likewise of major importance. But above all public education is needed, for the great majority of the general public has sufficient mature intelligence to take the steps needed to prevent fires and to avoid interference with the effective functioning of fire protection devices once it really understands the subject.

Meetings of Board of Directors.

Chicago, May 8, 1939.

Present.

Albert T. Bell, Chairman
S. D. McComb, President
Alvah Small, Vice-President
D. J. Price, Vice-President
George W. Elliott, Past President
Harold L. Miner, Past President
Franklin H. Wentworth, Secretary-Treasurer
Eugene Arms
Hovey T. Freeman
Russell Grinnell
C. W. Johnson
A. H. Kehoe
C. W. Pierce
H. S. Smith
R. E. Vernor
J. L. Wilds

Business Transacted.

1. A communication from the United States Conference of Mayors requesting representation upon the Electrical Committee was discussed and referred to the Committee on Technical Committee Procedure for consideration and report to the Board at its next meeting.

2. It was voted to establish the policy of separating the duties of Secretary-Treasurer from those of the paid Association executive.

3. The annual report of the Treasurer was approved.

4. The report of the Chairman of the Board to the annual meeting was approved.

Boston, June 26, 1939.

Present.

Albert T. Bell, Chairman
Samuel D. McComb, President
Alvah Small, Vice-President
David J. Price, Vice-President
Hovey T. Freeman, Secretary-Treasurer
George W. Elliott, Past President
Harold L. Miner, Past President
Franklin H. Wentworth, Retiring Secretary-Treasurer and Managing Director
Eugene Arms
A. L. Brown
H. T. Cartlidge
Frank A. Epps
Russell Grinnell
C. W. Johnson
Arthur H. Kehoe
S. L. Nicholson
C. W. Pierce
H. Sidney Smith
Richard E. Vernor
Lloyd T. Wheeler
John L. Wilds

Percy Bugbee, General Manager
Robert S. Moulton, Technical Secretary
Horatio Bond, Chief Engineer

Business Transacted.

1. The following members were elected officers of the corporation for the year 1939-1940: President, Samuel D. McComb; Vice-President, Alvah Small; Vice-President, David J. Price; Secretary-Treasurer, Hovey T. Freeman; Chairman, Board of Directors, Albert T. Bell.

2. The recommendations of the committee appointed in June, 1938, to consider and report on the suggestion made by Managing Director Wentworth regarding a change in his status were adopted as follows:

(a) Mr. Bugbee was elected administrative executive with the title of General Manager charged with full direction of the affairs of the Association under policies established by the Board of Directors. He was also appointed Assistant Secretary and Assistant Treasurer to facilitate the handling of the Association's finances and records in coöperation with and as delegated by Secretary-Treasurer Freeman.

(b) Mr. Wentworth was retained in a consulting capacity.

3. Mr. A. L. Brown was appointed to the Committee on Technical Committee Procedure to fill the vacancy caused by the expiration of the term of Mr. F. T. Moses.

4. Messrs. Frank Epps and H. S. Smith were selected to complete the Nominating Committee for 1940.

5. The dates and place of the 44th annual meeting were discussed and referred to the following committee: Mr. A. T. Bell, Mr. S. D. McComb, Mr. George W. Elliott, Mr. H. T. Cartlidge and Mr. Percy Bugbee, to consider the points raised in the discussion and submit their findings to the Board for approval.

6. The following Program Committee was appointed: the President, the Chairman of the Board, and the General Manager, with authority to add to their number.

7. It was voted to continue the Field Service Fund in its present status as a special trust fund. It was further voted to designate Mr. Hovey T. Freeman as Assistant Treasurer of the fund in place of Mr. Franklin H. Wentworth.

8. The budget submitted by Treasurer Wentworth was amended and adopted.

9. The policy of charging a registration fee at the annual meeting was discussed and referred to the committee on the dates and place of the annual meeting for report at the next meeting of the Board.

10. It was voted to authorize the Executive Office to proceed with the preparation of a ninth edition of the Crosby-Fiske-Forster Handbook of Fire Protection. The following committee was appointed to pass upon the text on behalf of the Association: Mr. A. L. Brown, Chairman, and Messrs. Eugene Arms, Henry A. Fiske, David J. Price and Alvah Small.

11. A proposal by member Curtis W. Pierce for a change in the Articles of Association, creating five regional vice presidencies, was referred to a special committee to be appointed by the chairman, and to report at the next meeting of the Board.

12. It was voted to create a Committee on Fire Protection Engineering Education to promote instruction in fire protection in universities, colleges and technical schools. Dean John R. Lapham of the School of Engineering, George Washington University, was appointed chairman. The appointment of other members was referred to President McComb with power.

13. A proposed Transportation Section was discussed and the Executive Office, in consultation with the Program Committee, was authorized to arrange for a time and place on the next annual meeting program for a meeting of those interested in a possible future Transportation Section.

14. The question of the issuing of statements or resolutions involving policy by N.F.P.A. sections was discussed and the General Manager was instructed to study the matter and report on it at the next Board meeting.

15. The Chairman reported on contacts and correspondence with the Red Cedar Shingle Bureau relative to the Association policy on wooden shingle roofing. It was agreed to leave this matter in the hands of the Chairman.

16. On behalf of the Executive Office, Technical Secretary Moulton reported on conferences and correspondence with the International Association of Electrical Inspectors relative to their resolution, which was referred to the Executive Office by the Board at the January, 1939, meeting, stating that advices had been received from the I.A.E.I. to the effect that continued informal handling of the intercommittee relationships referred to would be satisfactory to them.

Committee Matters.

17 (a). It was voted to adopt the first of the two texts proposed for paragraph 191 of the Regulations on Air Conditioning Systems as referred to the Board by the annual meeting, subject to editing, to read as follows: "Mechanical refrigeration shall be installed in accordance with the Safety Code for Mechanical Refrigeration (ASA-B-9-1939)."

It was voted to submit the 1939 revision of the Regulations for the Installation of Air Conditioning, Warm Air Heating, Air Cooling and Ventilating Systems to the American Standards Association, under proprietary sponsorship procedure, as an amendment to the previous edition approved by the ASA as an American Standard.

17 (b). Proposed revision of the personnel of the Membership Committee was referred to President McComb with power.

17 (c). The report of the Committee on Technical Committee Procedure was approved, including action on the recommendations of the committee as follows:

Electrical Committee.

The Committee on Technical Committee Procedure reported consideration of the communication from the U. S. Conference of Mayors referred to them by action of the Board at the May meeting, also a request for representation from the National Association of Building Owners and Managers, and a further communication from the International Association of Electrical Inspectors. It was voted that

The U. S. Conference of Mayors be invited to designate five representatives to the Electrical Committee.

The present representation of the International Municipal Signal Association be terminated, on the ground that the interest of this group will be covered by the representation of the U. S. Conference of Mayors.

The present representation of the City of New York be terminated for the same reason.

The National Association of Building Owners and Managers be invited to designate a representative, subject to receipt of assurances from this association of their active interest and willingness to participate in the work.

The Executive Office be instructed to call the attention of the International Association of Electrical Inspectors to these changes as along the lines of their request for additional representation of the public interest.

Blower Systems.

Division of the existing Committee on Blower Systems into two separate committees on Air Conditioning and on Blower Systems with the following scope statements was approved:

AIR CONDITIONING. "The safeguarding from the standpoint of fire and other related hazards of systems for air conditioning, heating and ventilating, including the control of fans and the construction, operation and maintenance of filters, ducts and of related equipment."

BLOWER SYSTEMS. "The safeguarding from the standpoint of fire and other related hazards of blower and exhaust systems and fans for the removal of dust, vapor and refuse and for air conveying, including the construction, operation and maintenance of ducts and of related equipment, and the disposal of the materials conveyed."

Proposed Committee on Fire Gases.

A proposal to establish a Committee on Fire Gases with the following scope: "To investigate and sponsor research on the character and effects on life and health of gases produced in fires, and to analyze and promulgate the results of such study," was referred to a special committee to be appointed by the Chairman for investigation and report to the Board at its next meeting.

Lightning.

A communication was reported from Dr. M. G. Lloyd, Chairman, in which he stated his inability to secure results with the present personnel, and offered his resignation as Chairman. The Committee on Technical Committee Procedure was authorized to reorganize the committee in conference with Dr. Lloyd, who was continued as Chairman, subject to confirmation of the personnel at the next meeting of the Board.

Manufacturing Hazards.

A proposal to reorganize the Committee on Manufacturing Hazards, assigning its standard-making functions to new committees on Finishing Processes, Ovens and Furnaces, and Special Extinguishing Systems, to cover these respective subjects, and the standard on Spark Arresters to the Committee on Field Practice, and the creation of a Manufacturing Hazards Council with advisory functions, was approved in principle and referred to the Committee on Technical Committee Procedure for further consideration and report at the next meeting of the Board.

Regulations on Technical Committee Procedure.

It was voted that in these regulations the word "Secretary" be changed to "General Manager."

In order to eliminate possible misunderstandings respecting the procedure required in the development of standards, it was voted that the term "regulations," wherever it appears, be changed to "standards," with attendant editorial changes as necessary, to make it clear that the regular routine applies irrespective of whether a committee report is called "regulations," "recommended good practice," "code," or by any other name.

Committee Appointments.

17 (d). The list of proposed committee appointments was confirmed, except a proposed appointment to the Committee on Automatic Sprinklers, which was referred to the Committee on Technical Committee Procedure with power. The Committee on Technical Committee Procedure was authorized to act on further revisions and replacements prior to the printing of the 1939 Year Book, subject to confirmation at the next meeting of the Board. (The revised personnel of the committees will be shown in the 1939 Year Book.)

18. In view of the long and significant service rendered to the N.F.P.A. by Mr. Franklin H. Wentworth, the Board invited Mr. Wentworth to attend future meetings of the Board.

The 1938 Fire Loss.

Fire losses in the United States for the year 1938 were $265,591,231, according to the estimate of the National Board of Fire Underwriters. This represents an increase of $10,631,808, or 4.1%, over the losses of 1937. The following table gives the annual fire loss in the United States for the past sixty-four years.

Annual Fire Losses in the United States for Sixty-Four Years.

Year	Property Loss	Year	Property Loss	Year	Property Loss
1875	$78,102,285	1897	$116,354,575	1919	$320,540,399
1876	64,630,600	1898	130,593,905	1920	447,886,677
1877	68,265,800	1899	153,597,830	1921	495,406,012
1878	64,315,900	1900	160,929,805	1922	506,541,001
1879	77,703,700	1901	165,817,810	1923	535,372,782
1880	74,643,400	1902	161,078,040	1924	549,062,124
1881	81,280,900	1903	145,302,155	1925	559,418,184
1882	84,505,024	1904	229,198,050	1926	561,980,751
1883	100,149,228	1905	165,221,650	1927	472,933,969
1884	110,008,611	1906	518,611,800	1928	464,607,102
1885	102,818,796	1907	215,084,709	1929	459,445,778
1886	104,924,750	1908	217,885,850	1930	501,980,624
1887	120,283,055	1909	188,705,150	1931	451,643,866
1888	110,885,665	1910	214,003,300	1932	400,859,554
1889	123,046,833	1911	217,004,575	1933	271,453,189
1890	108,993,792	1912	206,438,900	1934	271,197,296
1891	143,764,967	1913	203,763,550	1935	235,263,401
1892	151,516,098	1914	221,439,350	1936	266,659,449
1893	167,544,370	1915	172,033,200	1937	254,959,423
1894	140,006,484	1916	258,377,952	1938	265,591,231
1895	142,110,233	1917	289,535,050		
1896	118,737,420	1918	353,878,876		

NOTE:—Previous to 1916 figures obtained from the records of the New York *Journal of Commerce*, deducting the Canadian losses. Subsequent years are based on returns to the Actuarial Bureau of the National Board of Fire Underwriters, adding 25% for unreported and uninsured losses. Since 1935, 30% has been added for unreported losses. The figure for 1938 is based on estimates made by the Actuarial Bureau.

The statistics of individual cities on the following pages have been compiled by the N.F.P.A. Executive Office from reports furnished by the fire departments. Blanks in the tabulation indicate that the cities do not report these figures or have not responded to requests for their reports. These reports are not all compiled on a uniform basis. Differences in methods of determining or estimating fire losses, and in differentiation between alarms and building fires, should be considered in use of these figures for comparison between cities. It should also be noted that a single large loss fire may distort the figures on loss per building fire, so that a high loss per building fire in a single year does not necessarily reflect on the efficiency of fire department operations. It is interesting to note that the average loss per building fire for U. S. cities of 50,000 population or over is $388.

1938 Fire Losses — Cities of 50,000 Population or Over.

	City	Total Loss	No. Alarms	No. Bldg. Fires	Loss Per Bldg. Fire
Alabama	Birmingham	$300,287	2991	1084	$277
	Mobile	93,811	1310	1185	79
	Montgomery	70,994	556	292	243
Arizona	Phoenix	57,205	586	299	191
Arkansas	Little Rock	329,919	1668	441	750
California	Berkeley	54,068	870	379	142
	Fresno	118,907	415	155	767
	Glendale	11,505	605	108	106
	Long Beach	92,752	1015	283	328
	Los Angeles	1,388,580	14,562	3735	371
	Oakland	541,966	2941	1186	456
	Pasadena	48,189	446	147	327
	Sacramento	205,438	1219	274	749
	San Bernardino	142,328	385	115	1235
	San Diego	115,195	2191	549	210
	San Francisco	.....	8155	3246	....
	San Jose	58,357	556	240	242
	Santa Monica	3,017	372	178	16
	Stockton	75,923	785	227	334
Colorado	Denver	231,414	2360	1220	189
	Pueblo	21,837	516	291	75
Connecticut	Bridgeport	200,851	997	413	487
	Hartford	159,695	1494	598	270
	New Britain	98,139	530	94	1410
	New Haven	194,997	1988	577	338
	Waterbury	109,659	1067	374	292
Delaware	Wilmington	81,321	768	386	210
District of Columbia	Washington	386,448	5299	1788	216
Florida	Jacksonville	172,724	1499	644	257
	Miami	72,919	2748	330	220
	Tampa	147,518	897	780	189
Georgia	Atlanta	305,168	3656	308	990
	Augusta	109,210	666	....	....
	Macon	79,801	484	254	313
	Savannah	41,706	676	445	94
Illinois	Berwyn	20,590	217	86	239
	Chicago	.....	23,976	8476	....
	Cicero	34,115	456	170	200
	Decatur	37,120	486	271	136
	East St. Louis	107,095	....	....	....
	Evanston	92,215	669	232	397
	Oak Park	11,600	419	244	47
	Peoria	269,828	1168	399	676
	Rockford	27,112	913	374	72
	Springfield	66,564	777	319	215
Indiana	East Chicago	13,795	406	61	226
	Evansville	383,798	1173	789	487
	Fort Wayne	168,572	1352	450	375
	Gary	78,559	982	353	207
	Hammond	70,208	537	218	322
	Indianapolis	415,550	3235	1941	214

	City	Total Loss	No. Alarms	No. Bldg. Fires	Loss Per Bldg. Fire
Indiana, cont'd	Muncie	$19,765	581	....	....
	South Bend	103,941	1164	565	184
	Terre Haute	59,305	833	386	153
Iowa	Cedar Rapids	46,693	626	324	144
	Davenport	42,296	718	134	315
	Des Moines	338,903	2275	967	351
	Sioux City	72,744	864	352	206
	Waterloo	116,727	670	245	477
Kansas	Kansas City	391,697	1762	637	615
	Topeka	37,092	925	373	99
	Wichita	97,288	1439	337	288
Kentucky	Covington	16,761	485	313	53
	Louisville	396,955	2613	1137	349
Louisiana	New Orleans	277,148	2304	851	322
	Shreveport	166,665	1160	304	546
Maine	Portland	235,367	1097	103	2280
Maryland	Baltimore	1,250,000	6979	3654	343
Massachusetts	Boston	2,227,887	9503	3465	643
	Brockton	69,707	1361	434	161
	Brookline	43,589	733	414	105
	Cambridge	356,798	1718	542	657
	Everett	131,564	788	151	872
	Fall River	136,521	1039	338	404
	Haverhill	90,616	837	565	160
	Holyoke	150,089	745	413	363
	Lawrence	113,420	917	251	452
	Lowell	122,875	1366	431	483
	Lynn	764,491	2288	539	1413
	Malden	91,595	239	82	1117
	Medford	74,600	848	167	446
	New Bedford	1,013,775	748	511	1988
	Newton	59,155	1260	208	284
	Quincy	107,876	1200	321	536
	Somerville	167,549	1417	424	395
	Springfield	273,953	1781	429	638
	Worcester	414,996	3067	963	430
Michigan	Bay City	61,745	797	288	214
	Dearborn	32,546	370	140	232
	Detroit	2,078,506	11,875	5984	347
	Flint	108,536	1555	857	126
	Grand Rapids	201,834	1038	307	657
	Hamtramck	40,945	303	270	151
	Highland Park	48,654	479	344	141
	Jackson	70,077	578	333	210
	Kalamazoo	239,511	656	330	725
	Lansing	77,749	795	257	302
	Pontiac	97,064	546	305	318
	Saginaw	87,603	881	250	350
Minnesota	Duluth	144,404	1204	307	471
	Minneapolis	1,475,623	3995	1266	1165
	St. Paul	567,666	2983	1037	547
Mississippi	Jackson	68,078	719	184	369

	City	Total Loss	No. Alarms	No. Bldg. Fires	Loss Per Bldg. Fire
Missouri	Kansas City	$709,722	5873	2234	$317
	St. Joseph	97,542	1399	443	220
	St. Louis	825,000	6483	3093	266
	Springfield	42,463	849	331	128
Nebraska	Lincoln	72,203	937	330	218
	Omaha	373,624	2735	1111	335
New Hampshire	Manchester	107,000	715	296	361
New Jersey	Atlantic City	98,956	650	381	259
	Bayonne	51,526	739	596	86
	Camden	176,560	924	249	710
	Clifton	99,427	421	77	1280
	East Orange	16,153	402	154	149
	Elizabeth	54,050	632	287	188
	Hoboken	136,619	367	221	615
	Irvington	15,034	248	147	102
	Jersey City	123,120	1949	1032	119
	Newark	645,950	3564	1574	410
	Passaic	194,824	402	183	1650
	Paterson	461,748	819	481	959
	Trenton	242,523	814	382	635
	Union City	50,635	533	185	273
New York	Albany	222,578	1406	715	311
	Binghamton	286,798	530	229	251
	Buffalo	846,945	3441	1268	618
	Mount Vernon	184,796	405	141	1079
	New Rochelle	20,903	299	138	151
	New York	7,878,335	39,244	16,069	490
	Niagara Falls	80,760	604	245	329
	Rochester	383,053	2868	767	500
	Schenectady	135,906	741	234	580
	Syracuse	120,182	1588	493	243
	Troy	87,242	654	269	324
	Utica	73,625	742	198	371
	Yonkers	112,519	1159	452	249
North Carolina	Asheville	22,173	525	192	115
	Charlotte	128,342	1383	655	195
	Durham	32,883	318	130	252
	Greensboro	38,563	633	190	202
	Winston-Salem	28,913	588	164	176
Ohio	Akron	151,529	1747	754	201
	Canton	79,816	525	211	378
	Cincinnati	619,677	3421	1317	470
	Cleveland	2,293,891	7991	2218	1034
	Cleveland Heights	90,747	584	226	401
	Columbus	153,496	2845	1443	106
	Dayton	260,986	1994	1161	224
	Hamilton	128,329	588	413	311
	Lakewood	22,275	282	71	314
	Springfield	136,481	720	407	335
	Toledo	697,848	2741	....	....
	Youngstown	75,031	1361	389	192
Oklahoma	Oklahoma City	166,507	2835	608	274
	Tulsa	108,411	3814	723	150

	City	Total Loss	No. Alarms	No. Bldg. Fires	Loss Per Bldg. Fire
Oregon	Portland	$434,722	4076	2850	$152
Pennsylvania	Allentown	62,292	310	121	514
	Altoona	18,170	640	518	35
	Bethlehem	62,550	147	59	1060
	Chester	62,551	331	165	378
	Erie	134,680	738	312	432
	Harrisburg	32,641	531	314	103
	Johnstown	50,144	578	387	129
	Lancaster	79,857	271	181	441
	McKeesport	11,619	310	267	435
	Philadelphia	2,823,170	8765	3851	734
	Pittsburgh	568,684	4710	2242	253
	Reading	15,840	421	320	49
	Scranton	181,169	766	394	459
	Wilkes-Barre	73,011	420	180	405
	York	27,690	235	169	163
Rhode Island	Pawtucket	192,951	914	336	574
	Providence	331,084	2976	540	613
	Woonsocket	146,596	559	157	934
South Carolina	Charleston	24,882	631	330	75
	Columbia	69,444	638	326	212
Tennessee	Chattanooga	98,090	1364	486	201
	Knoxville	86,447	1174	569	151
	Memphis	520,764	3499	1185	438
	Nashville	189,711	3034	917	207
Texas	Austin	67,978	1302	318	213
	Beaumont	37,151	688	503	73
	Dallas	606,201	4760	646	940
	El Paso	51,065	537	257	198
	Fort Worth	324,435	3520	930	349
	Galveston	162,314	430	209	776
	Houston	913,727	4174	1324	678
	Port Arthur	20,739	329	53	390
	San Antonio	159,570	3042	821	194
	Waco	93,969	863	222	423
	Wichita Falls	31,200	690	160	195
Utah	Salt Lake City	205,194	1655	724	283
Virginia	Norfolk	277,837	2276	825	337
	Richmond	77,617	1906	1067	72
	Roanoke	87,843	603	300	292
Washington	Seattle	469,589	4414	1646	285
	Spokane	137,069	1411	442	310
	Tacoma	249,591	2255	290	860
West Virginia	Charleston	32,832	494	142	231
	Huntington	90,430	870	342	264
	Wheeling	15,622	467	268	58
Wisconsin	Kenosha	19,889	447	223	89
	Madison	37,181	679	372	99
	Milwaukee	633,768	4283	1890	334
	Racine	30,798	417	228	135
Territory of Hawaii	Honolulu	74,640	826	243	306

U. S. Losses Higher for First Part of 1939.

Fire losses in the United States for the first five months of 1939 were $141,694,226. This is an increase of $9,960,606 over the loss for the same period of 1938. These figures are also the estimates of the National Board of Fire Underwriters.

	1936	1937	1938	1939
January	$27,729,930	$25,069,895	$27,676,337	$27,615,316
February	30,909,896	28,654,962	26,472,626	29,303,520
March	29,177,406	29,319,029	29,050,968	30,682,168
April	25,786,835	26,663,854	25,616,112	27,061,522
May	21,479,380	21,437,739	22,917,577	27,031,700
Total—5 months	$135,083,447	$131,145,479	$131,733,620	$141,694,226

Canadian Fire Losses, 1938.

Canadian fire losses for 1938 amounted to $25,899,180, according to statistics furnished by W. L. Clairmont, Senior Fire Prevention Engineer of the Department of Insurance at Ottawa. This is a greater loss by $3,153,122 (nearly 14%) than that for the year 1937. The number of fires reported in 1938 was 44,104, which is 456 fewer than were reported in 1937. Loss of life by fire during 1938 amounted to 263 lives, as compared with a loss of 246 lives reported in 1937.

Origin of Fires in Canada, 1938.

Causes Reported	No. of Fires	Property Loss
Smokers' carelessness and matches	13,719	$2,426,597
Stoves, furnaces, boilers and pipes	3,972	1,803,208
Defective chimneys and flues	3,870	1,690,267
Electrical wiring and appliances	2,625	2,394,278
Miscellaneous known causes	1,855	1,233,507
Sparks on roofs	1,773	505,469
Lightning (a) buildings rodded	25	19,322
(b) buildings not rodded	1,509	551,655
Exposure to adjacent building fires	1,389	1,299,734
Petroleum products and other volatiles	1,052	600,681
Sparks from open fires	1,004	196,872
Hot ashes and coals	692	90,331
Portable lamps, lanterns and open lights	580	208,127
Spontaneous ignition	480	588,313
Hot grease, oil, wax, asphalt, etc.	411	69,905
Incendiary	293	537,602
Explosions (other than petroleum products)	265	156,524
Friction	103	79,368
Fireworks	63	6,142
Steam and hot water pipes	40	60,677
Motion picture film ignition	11	10,968
Hot and molten metal	10	759
Unknown	8,363	11,357,746
Total	44,104	$25,899,180

A Decade of Fire Losses in Canada.

Year	Property Loss	Year	Property Loss
1929	$47,499,746	1934	$25,437,840
1930	46,109,875	1935	23,221,521
1931	47,117,334	1936	21,549,484
1932	42,193,815	1937	22,746,058
1933	32,676,314	1938	25,899,180

Occupancy Record.

	1938		Ten Years 1929-1938	
	No. of Fires	Loss	No. of Fires	Loss
Dwellings (all classes)	33,044	$6,089,663	310,716	$103,896,943
Farm property (excluding dwellings)	2,878	3,004,251	41,705	36,039,654
Retail and wholesale stores	1,887	3,547,126	43,160	79,433,208
Manufacturing properties	974	3,225,233	8,907	56,802,369
Churches, schools, and institutions	442	1,706,433	5,347	18,454,711
Miscellaneous property	4,879	8,326,474	40,397	18,824,382
Total	44,104	$25,899,180	450,262	$313,451,267

1938 Fire Losses — Cities of 50,000 Population or Over.

The figures contained in the following table have been compiled by the N.F.P.A. Department of Fire Record from reports received from the cities listed. The average loss per building fire for this group of fourteen cities was $814. But for the $780,000 loss involved in the Canadian Pacific Railway pier fire at Vancouver, the average loss per building fire would have been reduced by approximately $170.

	City	Total Loss	No. Alarms	No. Bldg. Fires	Loss Per Bldg. Fire
Alberta	Calgary	$201,107	483	117	$1719
	Edmonton	140,795	704	315	446
British Columbia	Vancouver	1,312,085	3119	420	3121
Manitoba	Winnipeg	304,608	3301	363	840
New Brunswick	St. John	101,000	626	293	345
Nova Scotia	Halifax	171,757	653	247	695
Ontario	Hamilton	189,294	1015	253	748
	London	53,706	448	213	251
	Ottawa	430,177	1615	935	460
	Toronto	1,557,098	4099	3077	507
	Windsor	86,500	659	287	300
Quebec	Montreal	1,589,601	5940	2738	582
	Quebec	421,181	2538	377	1115
Saskatchewan	Regina	58,620	336	219	267

The Forest Fire Situation, 1939.

By Roy Headley,
Chairman, N.F.P.A. Forest Committee.

Organized forest fire control, as we know it today, has grown up within the last 34 years. During that time, the climate has taken an unfavorable swing, and the human use of forested areas has increased enormously. The task of protecting American forest land from fire, which seemed so simple and easy in 1905, has proved to be complex and baffling.

But the adverse trends of weather and human use of the forests have been accompanied by certain favorable developments, such as growing public interest in forest fire control, a typically American development of a new technology to meet the need, and a better understanding of the nature and importance of the problems of human behavior which are involved.

One may "view with alarm" or "point with pride" when speaking of forest fire control as of the year 1939. Either attitude could be supported factually, but neither would be particularly helpful. It is more worth while to try to see the highlights of the problem in a perspective which will help evaluate the advances which have been made and disclose where future effort may be expended most fruitfully.

Current Losses.

The first thing to consider is the completeness of organized protection and the size of losses now being experienced. Various people, including some members of Congress, are inclined to say that the forest fire problem has been solved, and therefore needs little further attention except from the executives and technicians directly concerned.

As shown by Senator McNary's article in the April issue of the magazine *American Forests,* the fact is, that of the 423 million acres of state and private land needing protection, only a little more than half has been brought under organized fire control. Of the total of over 23 million acres burned in 1937, nearly 22 million acres, or 94 per cent, were lost on unprotected forest land. Most of this unprotected land, and most of these losses are in the South, where fire seldom produces complete devastation, but does reduce the yield of timber products by about half. Full yields of forest products would mean much not only to the prosperity of the South, but to the economic welfare of the whole country. It should be remarked here that country-wide losses in

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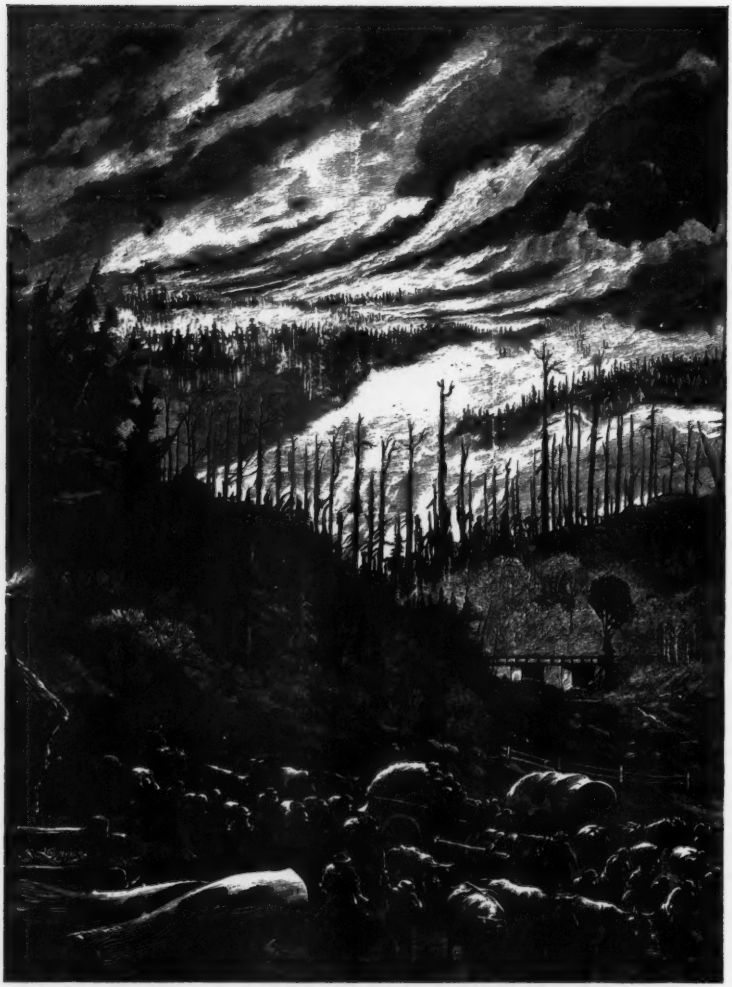
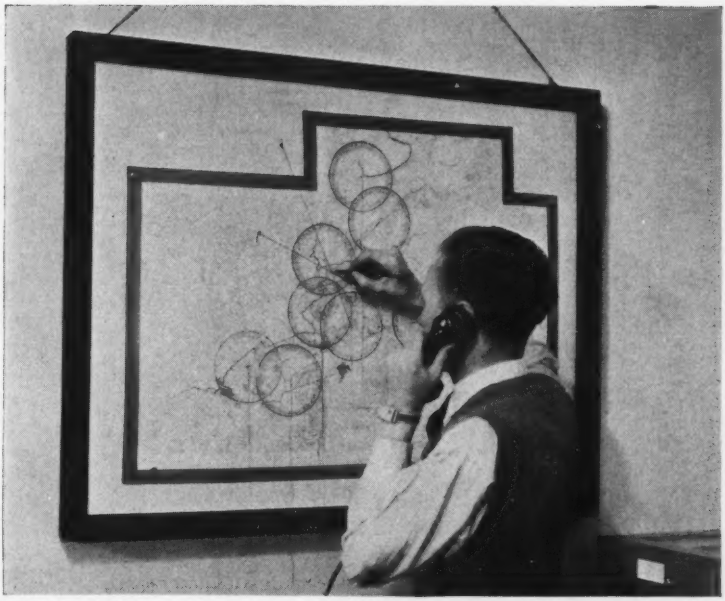
This article was presented as a paper at the 43rd Annual Meeting of the National Fire Protection Association, Chicago, May 8-12, 1939. For discussion, see Proceedings (printed as Part 2 of this QUARTERLY), page 238.



American Forests.

This rare old cut of the tragic Peshtigo forest fire in Wisconsin appeared in Harper's Weekly for December 2, 1871. This forest fire, the most calamitous in American history, swept over two thousand square miles and took 1500 lives. In addition to Peshtigo, where 700 persons died, the fire destroyed Brussels, Little Sturgeon and other settlements. The disaster would have been better known had it not occurred on the same evening as the famed Chicago conflagration of 1871.



U. S. Forest Service.

A fire control dispatcher in a District Ranger's office is shown determining the exact location of a fire by means of a map. Each lookout man sighting a fire reports by telephone the direction as indicated by the direction finder in his tower. These reports plotted on a map give the exact location of fires too far distant to be accurately located by a single observer.

1937 were the lowest since 1922, due in large part to favorable weather in 1937. The average loss on unprotected areas for the 5 years, 1933 through 1937, was over 33 million acres.

In the National Forests, losses have been gradually reduced from a high of over 25 thousand acres burned per million acres protected in 1910, to a low of 556 acres per million protected in 1937. Losses per million acres in 1938 went up to 1050 acres, and may go up still further in 1939, which promises to be a year of unusual drought and difficulty in the West.

Although the National Forests are relatively well protected, the difficulty and uncertainty of the job are illustrated by an experience in 1938 on the largest fire of the season — the Chetco lightning-caused fire in the Siskiyou National Forest in southwestern Oregon. On this fire, detection and initial action were prompt and all that could be expected. Subsequent management was excellent, if judged by present standards. Every effort was made to utilize modern techniques. For example, 112 tons of supplies were delivered to fire camps by the use of airplanes, and thousands of the new type of burlap parachute. Nevertheless, it took 26 days and over a quarter million dollars

U. S. Forest Service.

Typical of the fire hazard caused by the blowdown of some three and one-half billion feet of timber in the New England hurricane last September is this tangled mass of red spruce near Grantham, N. H.

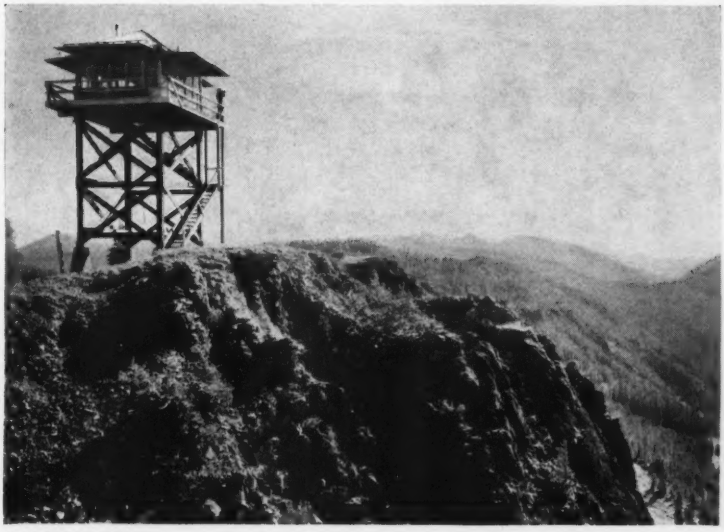
to bring the spread of this fire to a final stop; nearly 35 thousand acres were burned; and a precious growth of tree seedlings was destroyed. The troubles were, lack of roads, high and continuous winds, extremely rough country, and unusual drought.

The débris from the hurricane in New England represents a new peril. Fire control has been so effective in those states for many years that some men, even some foresters, say there is no cause for alarm. I cannot share this optimism. If there should be dry weather with some wind, terrible fires might occur despite all the precautions which have been and will be taken. It is reported that 4 lives have already been lost on account of forest and brush fires this spring in New England.

Consideration of the various angles of current losses on account of forest fires certainly gives no basis for relaxation or complacency.

Human Behavior.

The importance of the human element in fire control cannot be over-emphasized. Over 24 per cent of the annual crop of 172 thousand fires in the United States are due to incendiarism. Putting it another way, it may be said that only nine per cent of the total average annual crop of fires is due to lightning. All the remainder are due either to incendiarism, carelessness, thoughtlessness or pure accident. Very few can be classed as truly accidental.



U. S. Forest Service.

Little Bald Mountain fire control lookout tower in the Snoqualmie National Forest, State of Washington. This is typical of lookout towers protecting National Forests.

It may be said that if one had to choose between an effort to influence the human behavior which causes all these fires, or an effort to improve the technology of forest fire detection and suppression, the logical choice would be to work on human behavior and habits.

Human behavior is important in another way. No matter how excellent the equipment nor how good the technical plans for fire detection and suppression, the outcome depends upon the trained skill and intelligence which human beings apply to these jobs.

Efforts to influence human behavior are by no means being neglected; but human habits are stubborn things. It will be a long, difficult undertaking to reshape them.

Public Education and Response.

Much is being done to enlist the active interest and coöperation of the public. As reported last year, State N.F.P.A. Committees have been organized in Mississippi, Tennessee, Kentucky and Missouri — in the heart of the worst trouble zone. Among other things, these Committees are working to get courses of instruction on fire prevention included in public school curricula, and they are giving invaluable aid to state and other agencies which are striving to get a forest fire prevention movement rolling in those states. The Forest Committee has no specific report to make this year except to say that

O. C. Burkha.

A roaring forest fire, involving entire trees, shown as it jumped a road the morning after it destroyed the towns of Bandon and Prosper, Oregon, in September, 1936. Thirteen persons lost their lives when this fire swept through Bandon.

these State Committees are plugging away with the active support and coöperation of the national and state forest protection agencies, and that in due time this effort may be expected to bear results commensurate with the active interest displayed in forest fire control by the N.F.P.A.

Posters are now being lithographed from a second forest fire painting by James Montgomery Flagg. The painting was obtained this year through the financial coöperation of the American Forestry Association, and arrangements are being made for the Executive Office of the N.F.P.A. to distribute such posters as may be desired by the membership of the Association.

The American Forestry Association has devoted its entire April issue to forest fire prevention. This year's painting by Mr. Flagg is reproduced on the cover. The publication carries so much information and inspiration that it should serve as a manual for use by all public-spirited people who are willing to exert their influence for better forest protection. The Association has printed an extra supply of this issue. Copies may be obtained from the American Forestry Association, 919 17th St. N. W., Washington, D. C. The cost is 35c per copy with a 10 per cent discount on orders of 25 or more.

Other recent publications are a Glossary of terms used in forest fire control just printed by the Forest Service of the Department of Agriculture, and obtainable from any Forest Service office without charge, and the Fire Control Equipment Handbook compiled by the Forest Service and for sale by the Superintendent of Documents, Washington, D. C., at $1 per copy.*

*Remittances should be made to the Superintendent of Documents only.

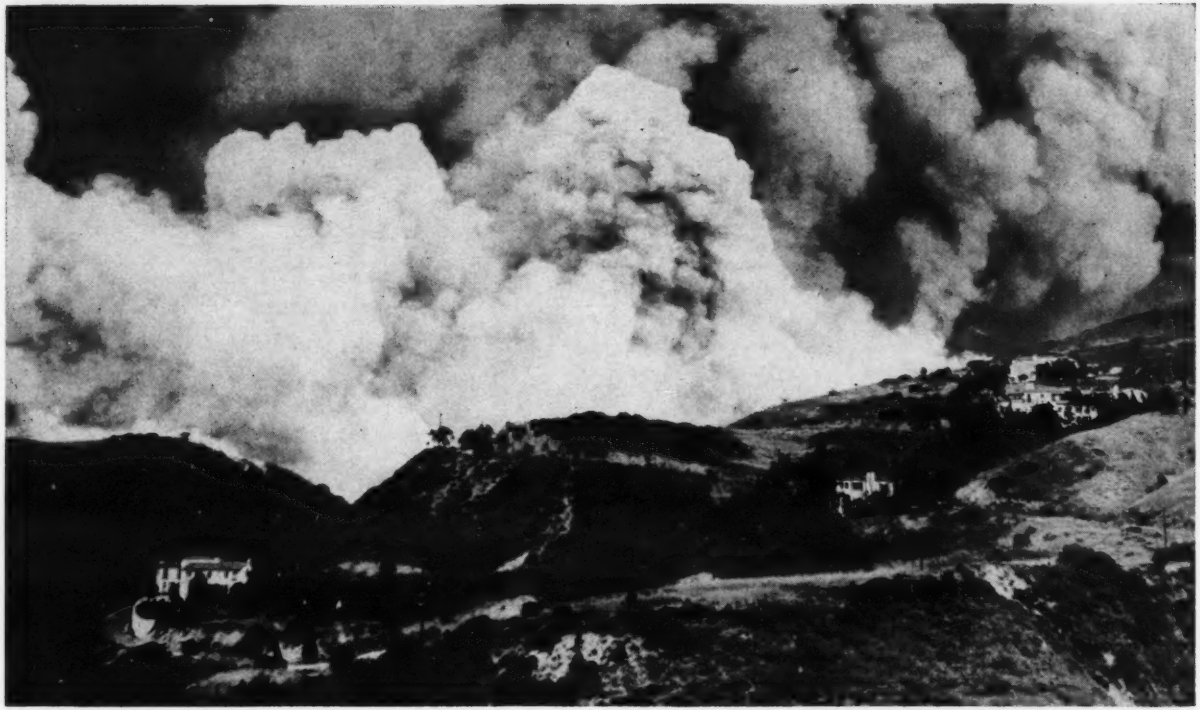
One by one, important national organizations are throwing their full organized support behind forest fire prevention. As a result of nearly two years of preliminary work, the American Legion has adopted a nation-wide program in support of conservation and fire control. This will reach all the way out to the individual Posts and will greatly stimulate and widen the excellent coöperation already received from this organization in individual instances. The American Association for the Advancement of Science has set up an Advisory Council on Human Relations, which will bring to bear on fire prevention problems the best that the modern sciences of psychology and sociology have to offer. This Council listened one day last winter to a presentation of fire prevention problems by National Forest Service fire control men from all over the country, and has responded with an inspiring degree of enthusiasm. Many important by-products are already coming from this new coöperative relationship, including such things as fire prevention moving pictures, a scheme for determining the actual educational effect of moving pictures, a textbook on teaching of conservation through art work, and the inclusion of fire prevention material in texts for school use.

The Red Cross is the latest organization to take up forest protection aggressively on a national scale. Fire prevention does not seem closely associated with the activities of the Red Cross. It is all the more significant, therefore, when this great organization lends its sanction and support to this work.

The urgent need of fire control is not doubted by the sort of people who form organizations for mutual benefit. They are in sympathy with forest protection. The only problem is to convert passive sympathy into effective sympathy. This can only be done by active participation of organized groups. Federal and state officials cannot do it alone. To be successful, such official agencies must be supported by a wave of interest and action by organized groups. It must be made socially unthinkable to be careless with fire; pervasive pressure must be brought to bear upon scattered anti-social individuals who still cling to careless fire setting habits; and state and federal authorities must feel a public demand for expenditures sufficient to cope with fires due to lightning and truly accidental causes.

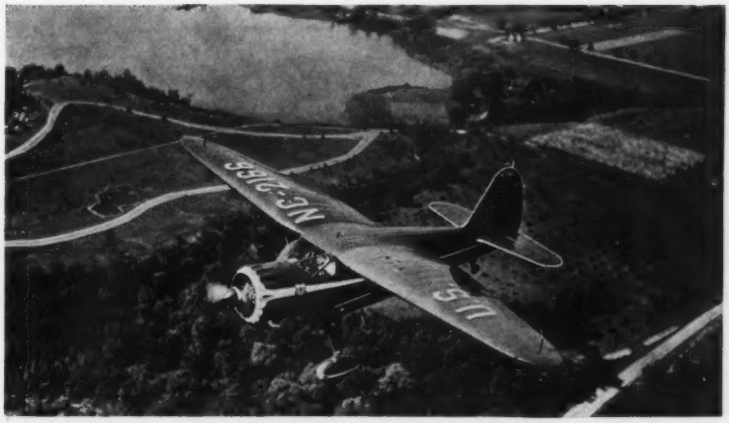
Fire Control Technology.

The great variability in the behavior of forest fires and the equally great variation in conditions and terrain encountered in detecting and combating forest fires, necessarily require a technology of great complexity. Machines, methods and instruments which will be in use 25 years from now will be so different that, to the men of that day, our technology of today will be thoroughly antiquated. We can only move up one step at a time, however, toward the technology of the future.



Wide World.

One of the forest fires that caused $3,000,000 loss in Southern California last November. Starting in inaccessible mountain areas the fires, aided by high winds and low humidity, spread rapidly. In addition to a large hotel, homes and camps, important watershed areas, needed to prevent floods, were destroyed.



U. S. Forest Service.

The U. S. Forest Service Airplane has been used in experiments in the use of chemical solutions for attacking fires from the air.

A few of the more important steps now being taken may be of interest.

Experimental use of foam is continuing. The man-pack can equipment previously developed for this purpose may have to be entirely redesigned. The use of foams on woods fires has been somewhat disappointing.

Aside from foam, the most promising chemical yet discovered by our chemists is monoammonium phosphate. Some four tons of this chemical are being purchased for use in the National Forests during the coming fire season. When an inhibitor to prevent corrosion is added, this chemical can be used in the man-pack equipment we already own for use in the National Forests. Experiments have not been conclusive as to the value of this solution in comparison with plain water. Depending on conditions, its effectiveness may be anywhere from 33 per cent to 200 per cent greater than that of an equal weight of water.

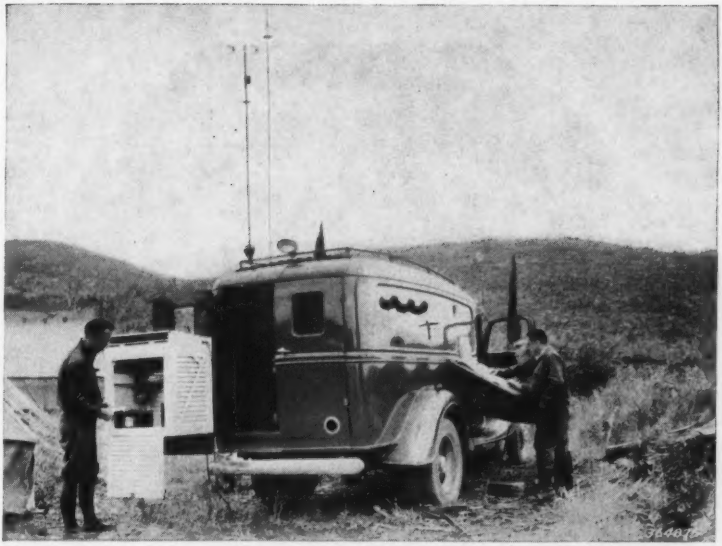
The Forest Service plane, assigned to experiments in attacking fires directly from the air, is being transferred to Portland, Oregon, and this experimental project has reached the stage which will permit a sustained series of tests on real and artificial fires in the actual woods. At best, the development of techniques for aerial attack on small fires with types of aircraft now available is a long shot. When ships of the hovering type, with a worthwhile payload capacity, become available, aerial attack on forest fires will doubtless become a commonplace feature of forest protection. A ten per cent solution of monoammonium phosphate will probably be used in this season's work, because even if this chemical does not prove to be worth bothering with in ground work, it will at least be worth using when aerial transportation of liquids is involved.

U. S. Forest Service.

A new power driven tool for making the shallow trench used in stopping forest fires is proving very satisfactory, although there has been difficulty in obtaining efficient light weight engines.

The new power driven tool for making the shallow barrier or trench used in stopping forest fires, which was mentioned last year, is coming along very satisfactorily. Forty of the machines have been made up and distributed throughout National Forest regions for use this Summer. If the machine lives up to expectations, hundreds or even thousands will be purchased for use in the National Forests as rapidly as funds become available. No wholly satisfactory light engine for this machine has been found as yet. Really efficient engines of the right dimensions and less than 50 pounds in weight are hard to obtain.

The development of instruments and techniques for determining and even forecasting forest fire danger in a way suited to direct and confident use by executives, is also progressing satisfactorily. This system of determining and integrating fire danger elements, such as moisture content of fuels, wind, humidity, etc., is distinct from but dependent upon weather forecasts. In important instances during the summer of 1938, forecasts of fire weather were disappointing. The Weather Bureau is, however, very much alive to the importance of this form of forecasting, and is formulating a program which in due time may be expected to put their fire weather forecasting for the entire



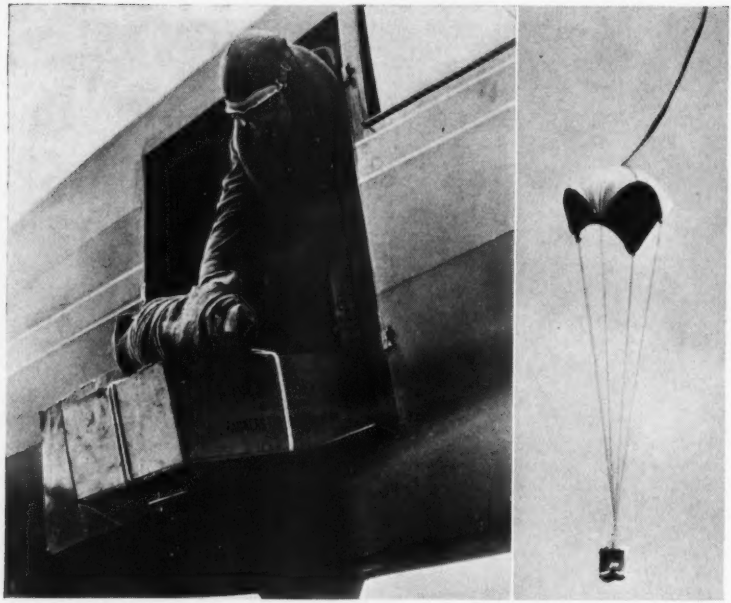
U. S. Forest Service.

Weather conditions largely govern the relative class of fire danger in a forest and the corresponding initial protective force required for suppression. A mobile fire weather forecasting unit of the U. S. Weather Bureau is shown in action.

forested portion of the United States on at least as good a basis as weather forecasting for commercial air transport purposes.

One very satisfactory development has been the use of conventional aircraft for delivery of supplies and equipment by means of cheap burlap parachutes which can be made up by the hundred or thousand as needed in the progress of a serious fire in roadless areas. It is gratifying that this method has already been taken up by one western state (Oregon), which dropped 80 tons of supplies on one bad fire in state jurisdiction last Summer. While the method will undoubtedly be refined and improved, a complete and secure foundation has evidently been laid for use of this form of fire control transportation.

As previously mentioned in the reports of the Forest Committee, the task of suddenly recruiting, organizing and managing a force of from several hundred to several thousand men to fight a serious fire is almost beyond human capacity. The results obtained on the larger fires, per unit of human or mechanical energy available, have never been satisfactory. Two lines of development are outstanding at this time. A new form of organizing and handling men for work on the actual control line has been under active development for several years, and has now been adopted as standard practice in our North



U. S. Forest Service.

The use of aircraft for delivery of supplies and equipment in roadless areas is an important development. On one group of fires last year one hundred and twelve tons of supplies were dropped from airplanes using inexpensive burlap parachutes. At the left a load is about to be dropped from a plane and at the right is shown a half-case of eggs floating down to hungry fire fighters.

Pacific region. This is known as the "One Lick Method." While simple in theory, it requires considerable skill in application. As a means of training Forest officers in this method, a moving picture film has been produced for use in training only. The method is winning increasing favor and may in time double the usual output of control line construction per man hour.

Another experiment will be launched during the coming Summer which may result in some rather sweeping revisions of general practice in fighting the larger fires. In this experiment an attack will be made on such problems as the usual waste of energy in marching men long fatiguing distances between camps and points where the work is to be done. It is probable that when properly selected and led, men may be willing to go straight to a fire and never leave it until the spread of the entire fire has been stopped by the completion of a successful control line. Such men would, of course, have to have food and rest if the fight lasts more than 24 hours, but they might well eat and rest wherever they happened to be working. Cooked and palatable food would of course have to be supplied in abundance. This might be done by gypsy

U. S. Forest Service.

Where fire fighting operations last over 24 hours cooked food must be supplied in abundance, frequently making serious transportation problems. Pack horses are shown being loaded to take food and supplies to fire fighters in the Lolo National Forest in Idaho.

cooking right at the heels of the men, or cooked food might be transported to them by pack animals, on men's backs, or by airplane, according to circumstances. The usual types of food used in ordinary fire camps run to about ten pounds in weight per man day, which often builds up pretty impossible transportation problems. This weight can probably be reduced to three or four pounds by using rice, beans, dried meat, and similar foods with a relative high nutritive value per pound of uncooked weight. Water can be added to foods on the ground more easily than by transporting it all the way from a merchants' warehouse.

It may be remarked that in 1938, for example, the 73 fires in the National Forests which attained more than 300 acres in size did most of the damage. Five fires in the Siskiyou National Forest burned 22 per cent of all the area lost from over 13,000 fires in all the National Forests during the year. The problem of managing those larger suppression jobs therefore becomes a major problem which will be subjected to a fresh attack by this experimental venture.

Legislation.

The Forest Committee pamphlet, "County and Municipal Forest Fire Ordinances," published by the N.F.P.A., is now available for all who may have occasion to draft or promote this type of legislation.

In general, there is room for considerable improvement in the forest fire legislation of some states, but there is continued activity in this field and a fair rate of progress is being attained. A recent inquiry did not disclose any par-

U. S. Forest Service.

These denuded mountainsides of the Big Creek watershed in Idaho do not retard runoff from melting snow. Spring freshets sweep the valley, depositing silt, gravel, and fallen timber, and change the stream channel. Forest fire control is important not only for the economic benefits, but for watershed protection, flood prevention, soil conservation, fish and game protection and recreation.

ticular need for changes in Federal legislation. As a rule, this legislation is more advanced than actual practice.

Appropriation of funds is still sometimes woefully deficient, however. Some state fire control organizations, particularly in the South, are really faced by a task which is quite impossible with the funds made available to them.

In the issue of *American Forests*, previously referred to, will be found an excellent statement of the case for an increase in the Federal appropriation for coöperation with states, from the present figure of two million dollars to nine million dollars. Society in general needs effective forest fire control, not only for the economic benefits to society, but for watershed protection, flood prevention, soil conservation, fish and game protection, and recreation. Private owners of forested land cannot reasonably be expected to make all the expenditures necessary in the interest both of themselves and of society in general. It is logical and necessary for generous coöperation to be provided by both federal and state governments if fire control is to be made really effective on all forested land in the country.

Chicago Elevator Conflagration.

A series of grain dust explosions in Calumet Elevator A, operated by Rosenbaum Bros., Inc., in Chicago, Illinois, on the morning of May 11, 1939, resulted in the loss of nine lives and caused a conflagration which destroyed five large elevators, with a loss estimated at approximately $3,500,000. One of the largest concentrations of fire fighting equipment in recent years was unable to prevent the spread of the fire.

Property Involved.

The five elevators destroyed were built from about 1894 to 1900 and were all of the usual cribbed construction with walls of wood, metal clad, with masonry foundations. They were located in the southeast section of Chicago, on both sides of Slip No. 2, west of the Calumet River and between 102nd and 103rd Streets extended, and some distance east of Commercial Ave. They were all separated from other buildings in this district.

Three sprinklered elevators operated by Rosenbaum Bros., Inc., and known as Calumet A, Calumet A-Annex and Calumet C and auxiliary buildings, including large reinforced concrete grain tanks, were located on the north bank of Slip No. 2. The main elevators in this group were separated as follows: main elevator buildings A and A-Annex were about 190 feet apart, with intervening auxiliary buildings of brick joisted and frame metal clad construction and an elevated steel sprinkler supply tank on 211-foot steel tower; main elevator buildings A-Annex and C were about 100 feet apart, with intervening brick joisted and part frame metal clad auxiliary building occupying a considerable proportion of the space between these elevators. Elevators A and A-Annex were connected by an elevated bridge of non-combustible construction, about 195 feet long. Elevators A-Annex and C communicated through a non-combustible conveyor tunnel about 100 feet long.

Two unsprinklered elevators, and auxiliary buildings, operated by the Norris Grain Company, were located on the south bank of Slip No. 2. This property had formerly been sprinklered. Elevator A was detached about 140 feet from Calumet Elevator C located to the north across the slip. The main Elevator A of the Norris group was detached from Elevator B by a distance of from 55 to 70 feet. Elevators A and B communicated through an open steel bridge and a metal conveyor enclosure.

This account has been extracted from a comprehensive illustrated report published by the Chicago Board of Underwriters (Member N.F.P.A.) in collaboration with the National Board of Fire Underwriters (Member N.F.P.A.). Several members of the N.F.P.A. staff were present during the fire.

International.

The furiously burning ruins of Calumet Elevator A of the Rosenbaum Brothers plant in Chicago after grain dust explosions in the structure took nine lives and started a $3,500,000 fire. Norris Elevator A, shown in the right background, was destroyed later in the fire. At the left are concrete grain tanks which were spalled by the intense heat.

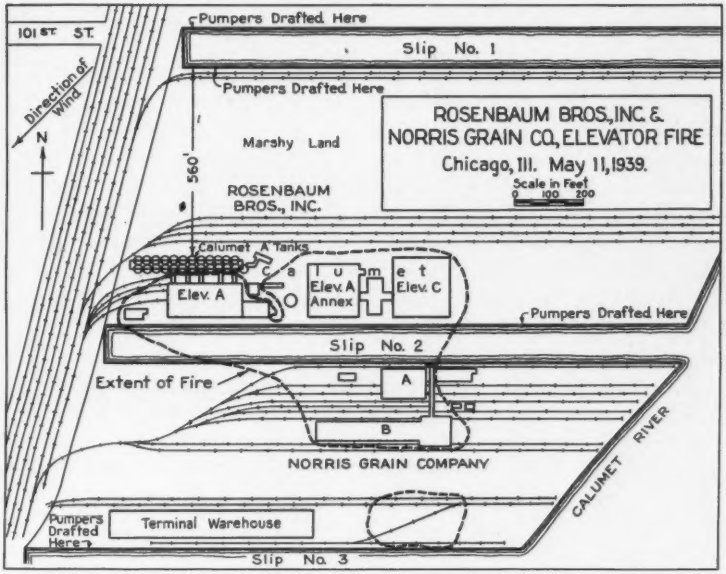
Weather Conditions.

The day of the fire was clear and moderately warm. Temperatures during the hours of the fire ranged from 45 to 51. The relative humidity for the 24 hours preceding the start of the fire averaged 43 per cent. The prevailing wind direction was constant from the northeast on May 11. During the height of the fire hourly average velocities reached 13 miles per hour, with gusts of up to 21 miles per hour.

Story of the Fire.

On the morning of May 11, 1939, operations were started in Calumet Elevator A at about 8:00 A.M. Two trucks were unloaded at the truck dump to the northeast. Several of the elevator legs were in operation. As nearly as can be determined, at 8:51 or 8:52 A.M. there was a severe explosion in Calumet Elevator A, which scattered portions of this elevator over a wide area. The cause has not been determined. Whether or not there was a preliminary puff or a small explosion in Elevator A cannot be definitely established, but it appears that the explosion may have centered at the east end of Elevator A. Inspections of the concrete storage tanks and of the elevator leg at the end of these indicate that the explosion was transmitted to them from Elevator A. The one employee at work in the concrete tank section died from burns before he could give any information.

Some employees in the elevator office about 60 feet to the west of Elevator A were conscious of only a single major explosion, but other testimony



would indicate that a series of explosions occurred. At any rate, the fire spread rapidly throughout all portions of Elevator A and the structure was rapidly consumed.

The automatic sprinkler piping in Elevator A apparently was largely destroyed by the original blast and this rapidly depleted the elevated tank storage through broken sprinkler piping. The automatic fire pump started, according to an employee who was passing through the pump house at the time of the explosion, but it was practically useless on account of the broken piping, and records indicate that the electric service to the pump was off momentarily at 8:58 A.M. and stopped at 9:12 A.M., due to grounding of the circuit.

The fire department companies first responding put hose streams in locations well chosen for an attempt to surround the fire in Elevator A. These included three companies at the west end and the Fire Boat *Medill* and one engine between Elevators A and A-Annex, which were driven from their positions by the extreme heat. The fire boat, at its first position, played water on the east end of Elevator A and soon, after a moored barge was pushed out of the way, moved ahead to play on the west wall of Elevator A-Annex. Later two similar positions were utilized by the fire boat in fighting between Elevators A-Annex and C. The effective reach of turret streams from the two squads located to the north between Elevators A and A-Annex was insufficient to prevent the radiated heat from igniting A-Annex. There is no apparent

evidence that an explosion contributed to the rapid spread of fire in this elevator.

An open sprinkler system installed to provide a water curtain on the west wall of Calumet Elevator A-Annex was not used. This was supplied from the sprinkler underground piping, with outside post indicator valve control normally closed. The water curtains between A-Annex and C were also similarly installed and controlled. In order for these water curtains to have been effective, it would have been necessary to shut off all piping supplying Elevator A and the power house. If it had been possible to reach and shut off the valves controlling these lines, a supply could have been furnished to the water curtains through the fire-boat connections provided along Slip No. 2. However, the proximity of these valves to the burning Elevator A made it impossible to operate them.

As the fire progressed in Elevator A-Annex, a second stand was taken between that elevator and Elevator C. This was done mainly by means of streams from turrets of squad trucks fed by the engines of companies responding to the early special calls. Since the road just north of the elevator was at this time practically impassable on account of the heat, a water tower and squad company, attempting to enter by driving along railroad tracks, became mired, and thus could not support fire-boat and engine turret streams already in operation.

Again the effective reach of available streams was insufficient to protect the upper portion of Elevator C, especially since the advantage of working from the top of a water tower could not be taken. This elevator became ignited and shortly after this was noticed, and while apparatus was being moved to the east end of Elevator C, another explosion occurred, originating in the cupola, and then blowing out the walls of the ground floor. From the downward direction in which this explosion traveled, it is probable that the intensity of the explosion was increased by dust shaken loose by the collapse of portions of the cupola. After this explosion, all portions of Elevator C burned fiercely.

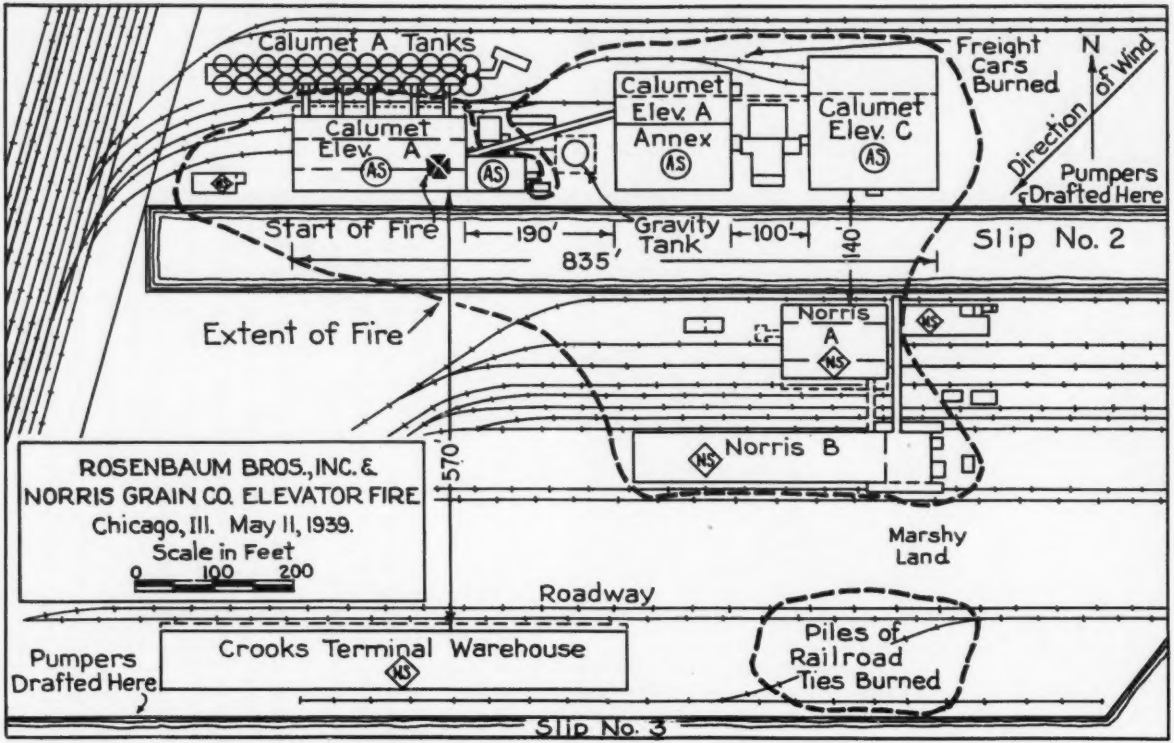
At this point, fire department operations were centered on preventing the spread of fire across the slip to the Norris Elevators. Two additional special calls for pumpers and others for squads and a water tower had been sent in. As this apparatus arrived, the pumpers were put to draft in Slip No. 3 and lines stretched to four squads and the water tower, set up along the south side of Norris Elevator B; a marshy strip of ground prevented getting apparatus through to the east end. Also this attempt included cooling the east end of Calumet Elevator C with squad turret streams and of operating streams from the fire boat *Medill* on the south side of this elevator and cooling the north side of Norris A. Within a short time, the *Medill* was assisted in this work by the fire boat *Busse*. The heat wave rising from the burning elevators, par-

International.

This airplane view shows the progress of the fire to the east against the wind, with Elevator A-Annex completely involved. Due to the miring of a water tower while being brought into position, firemen were unable to protect the top of Elevator C at the left. Flames visible from behind the concrete grain tanks are from Elevator A in which the fire started.

ticularly from Elevator C, apparently passed over Norris Elevator A, but struck the cupola at the top of Elevator B, which was 158 feet high and the highest point in either of these two elevators and about 400 feet from the cupola of Elevator C. This point was entirely beyond the effective reach of any stream from either fire boat or from ground lines set up on the east or south sides. Shortly after this, the cupola ignited. The progress of the fire in this elevator was very similar to that in Calumet Elevator C; apparently subsequent explosions spread the fire throughout within a short time. Some of the apparatus to the south was moved back when the danger of explosion became imminent, but the positions of most had been so chosen that they were able to remain. In spite of diverting one large fire-boat stream to the northeast corner of Norris Elevator B there was no possibility of combating this new exposure to Norris Elevator A, and it soon also became involved.

During most of this time, the heat wave spreading to the south had seriously threatened to ignite the Crooks Terminal Warehouse about 430 feet to the south of Slip No. 2 and only 180 feet from the nearest point of Norris


Calumet A Tanks
Calumet Elev. A
Calumet Elev. A Annex
Calumet Elev. C
Freight Cars Burned
N
Direction of Wind
Pumpers Drafted Here
Start of Fire
190'
Gravity Tank
100'
140'
835'
Slip No. 2
Extent of Fire
Norris A
Norris B
570'
ROSENBAUM BROS., INC. & NORRIS GRAIN CO. ELEVATOR FIRE
Chicago, Ill. May 11, 1939.
Scale in Feet
0 100 200
Marshy Land
Roadway
Crooks Terminal Warehouse
Piles of Railroad Ties Burned
Pumpers Drafted Here
Slip No. 3

Elevator B, and streams from two of the pumpers working in Slip No. 3 were devoted to the protection of this building. Heat and flying brands ignited the prairie grass and railroad ties to the east and added further exposure to the personnel working near this point.

By about 4:30 P.M. the fire was considered under control. Many of the later special call companies were returned to quarters that evening and others were returned gradually. The fire boats remained until Saturday, May 13, and at least one land company remained most of Sunday.

Loss of Life and Injuries.

It has been established that there were ten men working in various portions of Elevator A at the time the explosion occurred. Two of these men escaped with their clothing in flames, and one subsequently died in the hospital from the effects of burns, bringing the toll to nine dead or missing. The other is still in the hospital in a serious condition.

About thirty firemen received injuries in fighting this fire of from a minor to a serious nature, some requiring hospital treatment. The most seriously injured fireman is apparently on his way to recovery.

Fire Fighting Operations.

The original explosion which caused the fire occurred about 8:52 A.M. An engine company located near by at 105th Street reported to the Englewood fire alarm office that it was responding to a still alarm. The fire alarm office immediately struck a box alarm, sending 2 engine, 1 ladder, 1 squad, 1 high pressure, 1 fire boat companies and a battalion chief. By that time numerous telephone calls had been received, including notification that the Illinois District Telegraph Company had received both low water in gravity tank and riser water flow alarms at 8:53 A.M.

At 8:56 A.M. another box alarm was received from 103rd Street and Cottage Grove Avenue. Due to the remote location from the fire a full response of three engines, one ladder and a battalion chief was dispatched. Upon arrival the chief reported that there was no fire at that location. The fire alarm operator then dispatched two of the engines to the fire, because a third alarm had been received at 9:01 A.M. from the first box and these companies were part of the normal third alarm assignment. As no second alarm was sounded, response included apparatus for both second and third alarms. At intervals from 9:05 A.M. to 10:46 A.M. six special calls, each for five pumpers, and five special duty calls for special units, such as a water tower, high pressure wagons and squad companies, were sent out. Fire department operations were under the control of Fire Commissioner Corrigan, Deputy Fire Marshal Mullaney, Second Deputy Chief Fire Marshal Mackey, Marshal Moynihan of the 5th Division and two battalion chiefs. The total fire department response included 40 engine companies, 2 fire boats, 2 ladder trucks, 4 high pressure wagons, 2 water towers, 9 squads, 3 ambulances, 3 gasoline supply trucks, 2 light wagons

Slip No. 1 of the Calumet River, 560 feet north of the fire, was one of the principal sources of pumper suction. All but three of the pumpers took suction from Slips 1, 2 or 3. The long hose lines and high nozzle pressures used required an average pumper pressure of about 230 pounds.

and 1 fire insurance patrol. A total of 566 officers and men from both shifts worked at the fire.

General Tactics Employed.

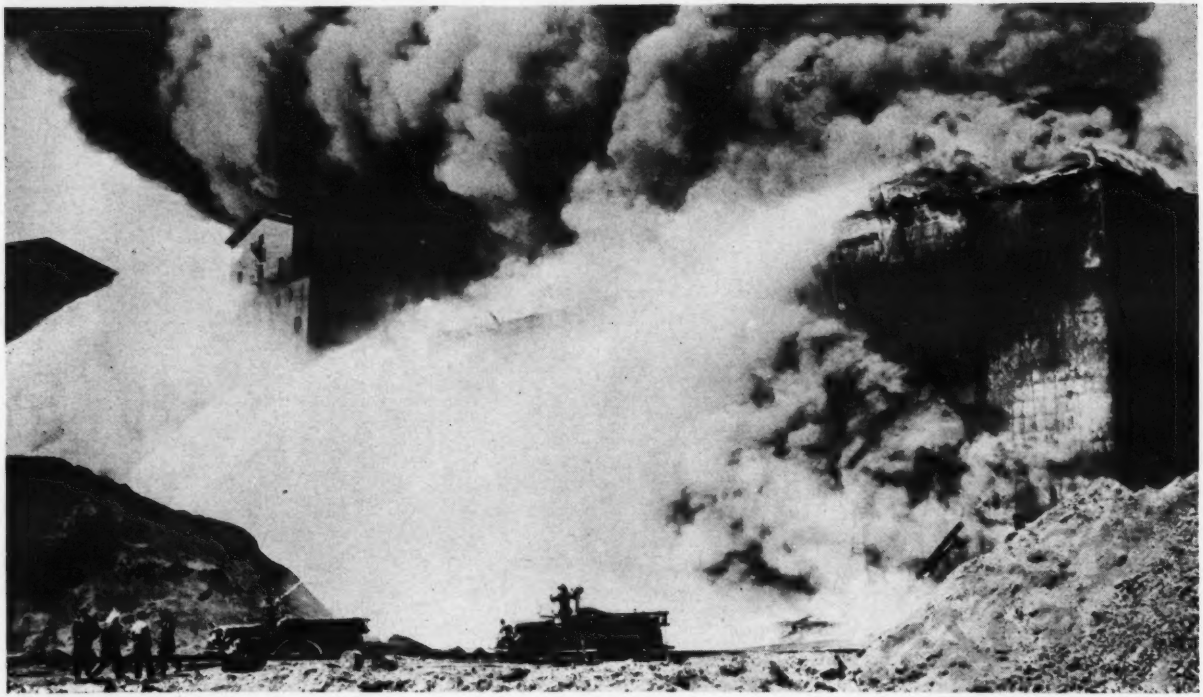
The successive stands by the fire department show that the commanding officers realized early that the effective reach of streams from hand lines would be utterly insufficient, and started promptly to develop heavy streams. Numerous 1¾-inch and some 2-inch streams were developed by land companies; the fire boat *Medill* worked a 3-inch stream on Elevator A-Annex and the west wall of Elevator C. Thereafter the fire boats delivered 1½- to 2½-inch streams. The effective vertical reach of such streams varies from about 100 to 125 feet and the horizontal reach from 150 to 175 feet, using nozzle pressures of from 100 to 130 pounds. Any increase in nozzle pressure or in size of tip produces only a slight increase in reach. These figures apply in still air, and under fire conditions the wind currents developed will reduce the effective reach of the streams. Water towers were used to gain elevation of streams as far as practicable. The effectiveness of operations was reduced by the intense heat which forced companies from their original positions to points remote from the fire. Nozzle operators, even in these new positions, had to be changed frequently and protected by hose streams.

The general principles of attempting to surround and protect exposures were followed out in so far as possible under the conditions which prevailed. The use of practically all types of fire department equipment and various hose layouts were resorted to at various stages of the fire: leads of hose were almost universally siamesed, effective use was made of 3- and 3½-inch hose and engines were placed in series where necessary to give the desired nozzle pressures. It was immediately recognized that the most feasible method of obtaining water supply was by draft from the slips, because of the remote location of hydrants. There was no difficulty in obtaining suction with any of the pumpers.

Service Performed and Supplies Used.

Of the 40 automobile pumping engines in operation at the fire, 6 were 1000-gallon and 34 were 750-gallon, making the total rated pumping capacity, at 120 pounds, 31,500 gallons per minute. Engines operated at from 150 to 325 pounds discharge pressure, averaging about 230 pounds and it is probable that the maximum delivery from them was at a rate of about 16,000 gallons a minute. The time in service at the fire averaged 22.7 hours for each engine.

The fire boat *Busse,* built in 1937, has a tested capacity of 10,000 gallons a minute at 150 pounds pressure and was in service at the fire for 53 hours, 35 minutes. The fire boat *Medill,* built in 1908, had an original rated capacity of 9000 gallons a minute at 150 pounds pressure and was in service for 50 hours. These boats probably delivered together at a maximum rate of about 11,000 gallons a minute. The maximum total discharge for all equipment was about 27,000 gallons per minute.



International.

Powerful streams from the turret nozzles of squad cars were largely ineffective, due to the high metal clad walls and the flue-like action of the heavy timber cribs which were not accessible to hose streams. The elevator in flames is the Calumet C. The structure at the left is the Norris A across the slip at the south.

A total of about 34,000 feet of 2½-inch, 25,000 feet of 3-inch, and 9000 feet of 3½-inch hose was used at this fire.

During the fire, about 6817 gallons of gasoline, 305 gallons of lubricating oil, and 1661 gallons of fuel oil were used by the equipment working at the fire. The *Medill* had to return to her quarters twice during her service at the fire to replenish her coal supply; first at about 5:30 P.M. on Thursday and again at 11 A.M. on Friday.

Damage to Department Equipment.

One squad wagon was considerably damaged by fire and some other apparatus was blistered by the heat. About 6000 feet of hose was damaged, burst, burned, or buried. About 18 lengths of hose burst, or only slightly less than one per cent of the total laid, and this is not surprising, considering the higher than normal pressures carried. During the height of the fire, a falling wall damaged the superstructure of the fire boat *Medill* and the starboard turret burst.

Fire Department Protection for the City.

As companies responded to the fire, others more distant were moved into many of the stations. At the height of the fire, five engine and one squad companies had been made up with reserve apparatus and off-shift men and were in service; 20 engine and one ladder and one squad companies were in service in strange stations; 61 engine and all but three ladder companies were in normal service; and 34 engine, 2 fire boat, 2 ladder, 8 squad, 2 water tower, and 4 high-pressure companies were not replaced. The resulting company distribution gave very good coverage in all parts of the city.

Off-Shift Response.

At about 10:30 A.M. several radio stations began to broadcast a request for off-shift and physically fit retired members to report to the drill school. Off-shift members of companies working at the fire were sent to aid their units. Other men were sent to augment man power of companies in areas where the protection was somewhat depleted. The six companies made up with reserve apparatus had about 12 men assigned to each as they were put into service from 11:30 A.M. to 4:00 P.M. Records show a total of about 1118 men responded to the call, and only part of these were utilized; the remainder were held in reserve at their respective battalion headquarters.

Water Supply Operations.

The public water supply was distinctly a minor factor at this fire, since there were no public mains east of Commercial Avenue and only three hydrants were used by pumpers.

Police Department Radio Service.

A car equipped for two-way service was dispatched to the fire at 9:23 A.M., and upon arrival took a position to the northwest of Elevator A. At 10:15 A.M. F. M. Schnell, radio engineer, responded in another car equipped for two-way

service and carrying two portable combination receiver and transmitter units. A third car equipped for two-way service responded at 10:30 A.M., and apparatus in two cars was used for the transmission and reception of messages. At the fire one portable unit was set up, first to the north of Elevator A-Annex and later to the east of Elevator C, and communicated during the fire with the other portable unit located with the cars, which were in contact with the central complaint room of the police department, from which point messages and orders were relayed to the fire alarm office.

The radio service thus provided was used to direct Engine 37 (fire boat *Busse*) to its position at the fire; to request the response of fire department ambulances 2 and 6; to order gasoline trucks from the repair shop and fuel oil from a private company for the fire boat *Busse;* to direct the fire department chaplain to hospitals where injured men were located, and to facilitate passage of milk and beverage trucks into the fire zone because of lack of city water in this zone. It was also used to determine the apparatus coverage for the remainder of the city and the amount of apparatus actually in service at the fire for the information of fire department officials at the fire, and to refute the rumor that a wall had collapsed on men and apparatus.

Other Police Department Operations.

At the height of the fire about 60 men were on duty under the supervision of Chief Prendergast, chief of the uniformed force. Six patrol wagons and twelve squad cars were held in readiness for service. Special precautions were taken to hold back the large crowds because of the danger from sheet metal flying about.

Fire Insurance Patrol.

Chief Officer McAuliffe and Patrol No. 4 responded to the fire on the combined second and third alarm at 9:01 A.M. Upon arrival it was found that little effective salvage work could be done, and Patrol No. 4 was ordered to assist engine companies in laying lines and getting water on the fire. After the fire was surrounded, they were ordered back to quarters, arriving at 1:05 P.M. At 9:14 A.M. on May 13 Patrol No. 4 was sent to Crooks Terminal Warehouse, which had suffered some structural damage to the roof, to protect stock from possible damage from rain. It was found impractical to fully protect this roof, so several "catch-alls" were spread and 24 covers were left for the use of warehouse employees in case of need. The patrol was on duty about five hours.

Losses.

The loss to the five main elevator buildings involved in this fire is practically total. The amount of salvage which may be expected from the grain in these elevators is conjectural. The concrete grain storage tanks to the north of Calumet Elevator A show a considerable amount of spalling on the exposed sides of three and somewhat less on one other. The north row of tanks was very little affected. The metal roof house shows the effect of the intense heat

to which it was subjected. There may be considerable salvage of the 500,000 bushels of grain stored in these tanks, particularly in those to the north. The office building west of Calumet Elevator A was gutted, but the walls remain standing around the vault. The non-combustible truck dump east of the concrete tanks suffered little damage. The dryer building, east of Elevator A, seems to have suffered only moderate damage, but the dust house near by was totally destroyed. The elevator steel sprinkler supply tank is still standing, but shows the effects of exposure to heat. The boiler house, communicating with Elevator A, was gutted, but the walls and the brick stacks are still standing. The locker house was apparently not damaged, and the small pump house showed moderate damage. Between Elevators A-Annex and C, the power house, which contained the fire pump for the automatic sprinkler system, was totally destroyed.

In the Norris Elevator group the old power house, east of Norris Elevator A, is standing but shows the effect of moderate water damage. The dust house and machine shop, to the east, show little fire damage. The small brick motor house is badly damaged. The Norris office building was destroyed.

The Crooks Terminal Warehouse to the southwest suffered water damage and some structural damage to the roof.

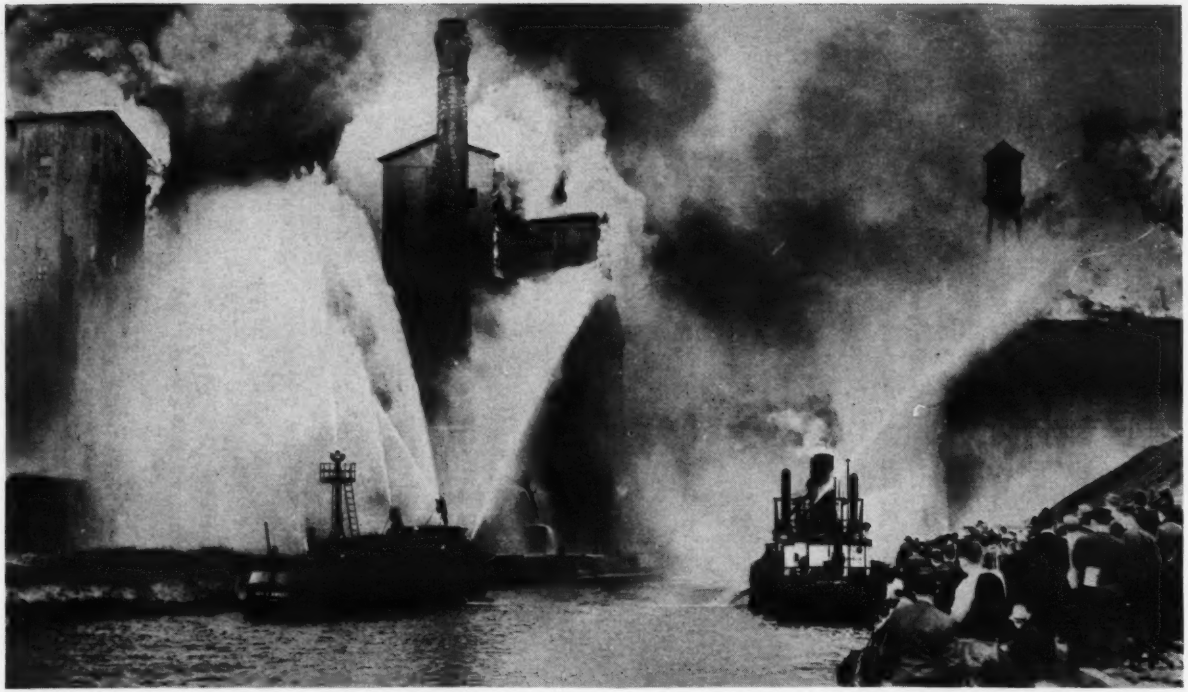
From estimates obtained from reliable sources it is believed that the total loss sustained at this fire will approximate $3,500,000, with possibly some salvage on the grain.

Conclusions.

The rapid spread of fire in the elevator of origin is typical of fires in elevators of this type of construction, particularly when the fire originates in an explosion. While there were some provisions for abating dust, these were not as complete as might be found in elevators of more modern construction. Sprinkler supervisory alarm records indicate that the sprinkler system did not operate until the explosion occurred and its effectiveness was nullified by the large number of broken riser connections which dissipated the water supplies.

The third alarm and two special calls were sent in almost immediately because it was recognized that heavy streams would be required to combat the fire which was spreading rapidly through Elevator A. The concrete storage tanks on the north side of the burning elevator prevented the department from effectively operating from this advantageous position, which position was important because of the wind direction at this time. This wind direction, driving the heat south over Slip No. 2, prevented the early-arriving companies from maintaining their positions at draft from this nearest source of water supply. The added length of hose lines involved in delivery from the suction supply at Slip No. 1 caused an inevitable delay in getting streams up to full effectiveness.

Without a water tower, which was not available at this early stage, it was impossible for the streams concentrated at the east end of Elevator A to keep



International.

Fire boats are shown operating in Slip No. 2 after the fire spread from Calumet C on the right to Norris Elevators A and B at the left. The shortest distance between buildings across the slip was 140 feet, but the intense heat ignited the top of Elevator B at the extreme left before Elevator A near the slip caught fire.

the radiated heat from reaching the 133-foot cupola of Elevator A-Annex. With this second elevator involved, the next step was to prevent spread to Elevator C. The lack of accessibility, because of the nearness of the fire road to the building already involved, greatly complicated this task. The moving of apparatus was hampered by railroad tracks and strings of box cars, and the miring of the water tower soon after arrival prevented operation of this important producer of heavy streams from one of the points of vantage. Again the heat radiating to the high cupola of Elevator C could not be halted and the cupola ignited. Any possibility of checking the fire so that the rate of combustion would be decreased and the heat radiated less rapidly toward the Norris elevators was lost when the explosion occurred in the building.

The tendency of heat waves developed in conflagrations to be transmitted in erratic currents was again demonstrated by the manner in which the more distant Norris Elevator B was first involved. Again an explosion prevented any hope of confining the burning to a moderate rate and shattered the only remaining hope for saving Norris Elevator A.

Fire-fighting to the south of Norris Elevator B was carried out under the severe handicaps of smoke, of an adverse wind direction, which not only hampered the reach of streams but also made positions perilous because of flying débris, and of a marshy strip of land which prevented apparatus from being taken to the extreme east. It was impossible for any companies to protect the exposure between Norris Elevators A and B. There was no particular difficulty in protecting the Crooks Terminal Warehouse against the severe exposure because of low height, effective fire department operations, and ready accessibility of water supply.

The unity of command was again exemplified to an even greater extent than at the stockyards fire. The use of modern fire department strategy was limited only by the conditions prevailing. The training of the department in the past several years in methods of developing master streams was well evidenced. The coöperation afforded by the police radio system was found of much value in giving rapid contact both between different parts of the fire and with the fire alarm office. Effective coverage was maintained and additional companies were brought nearer to respond to possible additional special calls.

The principal feature of interest in the structural conditions involved is the demonstration that metal clad frame buildings have no greater fire resistance than ordinary frame. In fact, under such severe exposure conditions, the metal clad building is probably at a disadvantage, both as to absorption of radiated heat and because of the inaccessibility of fire started behind the metal sheeting. It is somewhat doubtful whether the water curtains between Elevators A-Annex and C, if they could have been used, would have proved effective under such severe conditions. The fire shows that exposure hazard under conflagration conditions extends far beyond limits commonly considered safe.

Fire Hazards of Termite Control.

By Charles S. Morgan,
N.F.P.A. Department of Fire Record.

The structural problem presented by termites is slowly being recognized by builders and property owners, but the fire hazards which may be connected with the extermination of this insect have been given but very little consideration. Within the last three years explosions and fires costing the lives of at least four persons have resulted from termite extermination activities.

Inasmuch as any intelligent discussion of the problem requires some knowledge of the biology of the insect, let it be said here that there are two kinds of termites found in this country, subterranean and non-subterranean. The latter is found only on the southern Atlantic and Gulf coasts, along the southern boundary and on the coast of California. It causes but a small fraction of the damage wrought by the subterranean termite which is found in almost every state in the Union. An important fact regarding the subterranean termite is that it lives in the ground, and while it feeds on wood in buildings, it maintains passages to the earth to which it must have access in order to live. The non-subterranean termite does not require the moisture of the earth and attacks wood directly. The need of the subterranean termite for contact with the ground offers the property owner a most effective means of extermination.

There has long been controversy over the comparative merits of chemical and mechanical methods of termite control. Unbiased opinion of the leading investigators of this problem has supported the mechanical method of non-corrosive metal shields, while manufacturers of insecticides and exterminating companies using chemicals for soil poisoning and wood impregnation have naturally contested these views. Without question there are many cases of termite infestation in cheaply constructed or antiquated buildings where the expense of installing mechanical barriers would be unwarranted and in these cases chemical treatment could effect a measure of control more economically. Also, where the attack is by the non-subterranean termite, chemical methods are perhaps the only means of protection. However, our problem lies not so much in the relative merits of the two general methods of termite control as in the fire hazards attending their use.

The mechanical barrier method consists of installing a continuous copper or zinc shield between the sills of a building and the foundation, thereby prohibiting the passage of termites between their home in the soil and their food in the wooden structure. The only possible fire hazard connected with this installation would lie in the use of a soldering iron to fashion an unbroken shield. This hazard is small if reasonable care is observed, except in poorly ventilated basements containing flammable or explosive vapors such as might

be found in a distillery or paint shop. In such cases it is extremely important that thorough ventilation be maintained and that all highly flammable liquids be removed from the work area.

The chemical method of termite extermination consists of two phases, namely, wood impregnation and soil poisoning. These two phases are employed separately or in combination, depending upon the nature and extent of the attack. Many different chemicals and poisons are used for this purpose, a great number of which are highly flammable, including several proprietary preparations used by many exterminating companies.

That a serious hazard does exist in certain of the chemical treatments may best be shown by case histories from the N.F.P.A. fire records. In 1935 a Cincinnati distillery was found to be infested with termites and the management engaged the services of a leading, nationally known exterminating company. The treatment used by this company, in addition to soil poisoning, consists of the impregnation of all exposed and infested wood with their "secret" preparation. This liquid is applied from a compressor through a hose and nozzle under pressure of 150 lbs. per square inch. The nozzle is inserted into tight-fitting holes bored in the wood at frequent intervals. According to the manager of the distillery, assurances were given by the exterminating company that the poisons used were non-flammable and non-explosive. Two employees of the exterminating company were working in the basement with a 200-watt extension light hooked on the scaffolding needed to reach the sills, when the lamp dropped to the cement floor, instantly igniting the vapor of the solution being used. An alarm was sounded and the fire company, which arrived on the scene within six minutes, was able to extinguish the fire in about two hours. Eyewitnesses stated that almost instantly from the ignition of the fumes, the entire basement was a mass of flames, giving off a heavy black smoke. Both exterminators were overcome by inhaling the hot fumes and were sent to the hospital after being rescued by employees of the distillery.

The "secret" preparation used by this exterminating company was found, upon analysis, to consist of 85% of a distillate of crude oil somewhat lighter than kerosene, 12.5% orthodichlorobenzene and 2.5% inert substance. Even high-flash-point liquids and certain powders may burn with explosive force when nebulized by pressure guns, if an open flame or electric spark is within the vapor area.

In 1936 a fire occurred in Tulsa, Oklahoma, which cost the lives of two persons and seriously burned a third. According to accounts of the tragedy, two of the men were spraying for termites in the cellar of a home, while the third looked on from a distance, when suddenly an explosion occurred. The president of the firm doing the exterminating is said to have told authorities that the chemical used by his operators was neither explosive nor flammable. When tests proved that it was highly flammable, officers of the company said

that the men must have been using the wrong chemical. It might well be mentioned at this point that according to the best authorities on the subject, termite extermination cannot be obtained by any known surface spray.

Another similar fatal accident occurred at Terre Haute, Indiana, during the Summer of 1937. A crew of men were engaged to treat a house for termites, using a common proprietary compound. The solution was applied to the timbers by means of a compressor and a hoze with nozzle. The men had completed their work in the basement and were treating the underfloor of a sun porch, access to which was through a small opening on the outside. The area was illuminated by an extension cord light with reflector. At the completion of the work the man handling the nozzle started to pull out the hose and light at the same time. The lamp bulb was broken in the process and a sheet of flame enveloped the entire area, fatally burning the operator and a child who was looking on.

Subsequent investigation revealed that the solution used had a flash-point below ordinary room temperature and that this fact was not noted on any of the equipment. The fire department experienced great difficulty extinguishing the fire which followed because the timbers were saturated with the flammable liquid.

Some exterminators hold that in cases of slight attack by termites, soil poisoning alone is sufficient to destroy them. The danger that lies in this, even though treatment may be confined to soil outside the building, is illustrated by a fire that occurred in 1935 in an Omaha lumber yard. The conflagration appeared to have every evidence of arson. Investigation revealed that the owner of the yard had discovered that his property was seriously infested with termites. He was advised to saturate the ground wherever the attack occurred by driving rods at frequent intervals and filling the holes with a mixture of kerosene and creosote. In addition to this, he bored into the sills used to support the piles of lumber and, by means of a pressure gun, forced this mixture into these timbers. This completed, he restocked his yard. Within a couple of weeks sparks from a passing locomotive ignited the office building, resulting in a total loss to the yard and considerable damage to surrounding houses. Arson was suspected until investigation revealed the true state of affairs, because even the ground between the piles of lumber was on fire.

From these illustrations the importance of avoiding unusual fire hazards, both during and after treatment, will readily be seen. Property owners faced with a termite problem should protect themselves against unnecessary fire hazards and unreliable methods of control. In view of the great amount of popular misinformation regarding termites, the structural dangers attendant to them and the means by which they may be controlled, unbiased, expert advice is especially valuable. If possible the services of an independent consultant should be engaged, as many cases have been reported where insects have been

When fire destroyed the Rivett Lumber Co. yard at Omaha, Nebraska, arson was suspected because the ground between the piles of lumber burned with greater intensity than the lumber itself. Investigation revealed, however, that the earth had been saturated with a kerosene-creosote mixture to kill termites. The loss amounted to $80,000.

erroneously identified as termites by exterminators, and many of the nostrums offered for sale are worthless.

Though many methods of control have been commercially advocated, few have proven effective. Any method which attempts to control termites by simple extermination, such as spraying insecticides, fumigation, soil poisoning alone, etc., can hold out no hope for success. These methods fail because they attempt the impossible task of exterminating all the insects, whereas the most that they can hope to accomplish is only partial extermination and immunization. Yet this type of treatment is in common use in all parts of the country.

The only successful method is the more scientific insulation of all wooden material from the earth, thus cutting off the termites already within the building from their nests and preventing further invasions from the ground. Both results are accomplished by placing in the path of the termites an unbroken barrier. This barrier may be either mechanical or chemical, but the value of the latter method depends on:

1. the thoroughness of the treatment;
2. the toxicity to termites of the chemicals used;
3. the amount of retention of this chemical by the timbers and soil treated;
4. the ability of the treatment to resist leaching.

The failure of any one of these factors will seriously reduce the effectiveness and value of any treatment.

Prevention is by far the best protection, and freedom from invasion by termites in a new building is readily assured by observing a few simple, comparatively inexpensive measures during construction. Detailed recommendations for the prevention of termite attack in new buildings may be obtained from the U. S. Department of Agriculture in Washington, D. C.

Static Electricity in Blower Systems.

By A. H. Nuckolls (Member N.F.P.A.),
Chemical Engineer, Underwriters' Laboratories, Inc.

The origin of a number of fires which have occurred from time to time in blower systems has never been definitely determined. In many such cases evidence has indicated that no flame or other ordinary source of ignition was present and that the materials involved were not subject to spontaneous ignition. The question has therefore been raised as to whether charges of static electricity of magnitude sufficient to cause ignition might be generated in blower systems under common operating conditions. The general interest in this problem on the part of the N.F.P.A. Committee on Manufacturing Hazards, as expressed by Chairman Richards and various others, indicated the desirability of an investigation on this subject. Underwriters' Laboratories, Inc., accordingly undertook an investigation to ascertain the extent of the generation of static charges, using ducts of various material arranged to simulate actual conditions found in blower systems.

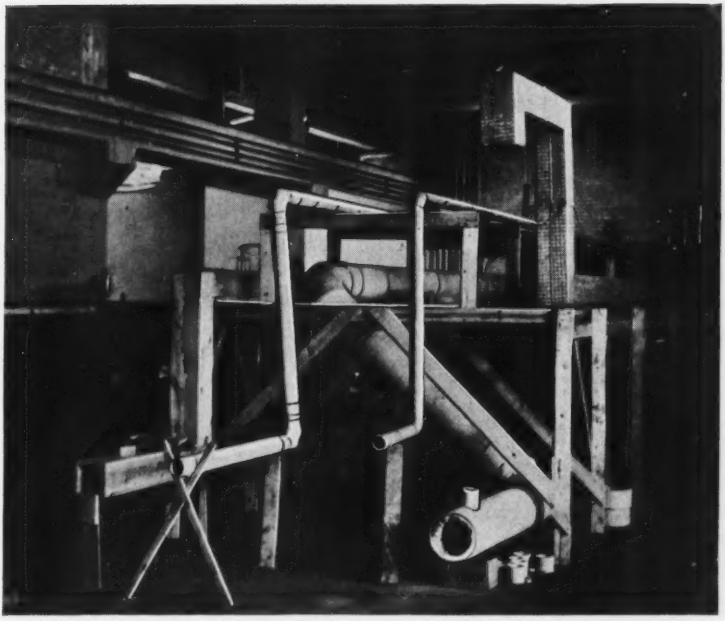
Sheet metal, Transite and wooden ducts of various lengths and sizes, some lined and some unlined, were employed in these experiments. The blower used was of the centrifugal type, driven by a 20-horse power electric motor and having a capacity of 80,000 cubic feet per hour at a pressure of one pound per square inch.

Three groups of tests were conducted: Air Tests, using relatively dust-free air; Dust and Lint Tests, in which measured amounts of various dusts and lint were introduced into the duct air stream; and Spray Tests, consisting essentially of the discharge of liquid spray into the duct air stream.

Air Tests.

In the so-called Air Tests, unfiltered air from the building containing only a trace of dust was forced through the duct system by means of the blower. Although the velocity of the stream was varied from 37 feet per second to 316 feet per second, tests for the electrification of the ducts, made with a gold-leaf electroscope, were negative.

NOTE: This article has been abstracted from Underwriters' Laboratories Bulletin of Research No. 8, entitled, "Generation of Static Electricity in Blower Systems," which should be consulted for the complete technical data.



Assembly of wood, metal, and Transite ducts used in making static electricity tests in blower systems.

Dust and Lint Tests.

In these tests, air was discharged through the various ducts singly, in the same manner as in the Air Tests except that a measured quantity of several kinds of dust or lint was introduced into the duct air stream. The various dusts used included grain, wheat starch, zinc oxide, and lycopodium.

Tests for the electrification of the duct and of the cloud of lint or dust as it issued from the end of the duct were made qualitatively with a gold-leaf electroscope and quantitatively with an electrostatic voltmeter. Repeated qualitative tests showed that marked electrical charges were almost instantly formed when lint or dust of the varieties used was admitted to the air stream in all of the different types of ducts. Quantitative tests were made only with the three-inch metal duct. It was observed that when any of the previously mentioned dusts was admitted to the duct air stream, even in comparatively small amounts, the net voltage in most of the tests, except when the ducts were grounded, was of a comparatively high order, the maximum voltage being over 10,000. Even with low-velocity air streams, of from 26 to 39 feet per second, the net voltages produced by the clouds were relatively high, being 2500 to 6300. A comparatively small amount of lint produced a voltage of

5000. When the metal duct was grounded, charges of from 200 to 7500 V. were produced by the dust clouds.

While determination of the influence of the kind or nature of the dust or lint, and of such variables as concentration, velocity, and fineness, on the generation of static was not made, it was observed that within certain limits the magnitude of the static charge varied directly with the concentration of the dust or lint, fineness, and velocity of air stream, and inversely with the humidity of the atmosphere.

Spray Tests.

By means of a spray apparatus, a spray of gasoline (74 Baumé) or of ethyl alcohol (absolute and 95 per cent) was projected into a 3-inch insulated metal duct about 54 feet in length. This spray was directed toward the outlet. Qualitative tests made with a gold-leaf electroscope revealed that only slight electrification of the duct occurred in any of the spray tests conducted.

Conclusions.

While but little data are available as to the minimum static charge required to cause ignition by spark discharges, it is known that static charges of the magnitude of those obtained in the Dust and Lint Tests may cause ignition. It is likely that charges of lower potential than 5000 V., under favorable conditions, may cause the ignition of readily combustible materials.

It is therefore evident from the results obtained by these experiments, that blower systems for dust, lint or vapor removal should be electrically grounded to prevent the accumulation of dangerous static charges.* Although grounding of the ducts cannot be depended upon under all circumstances to eliminate static electricity, if all the joints of metal ducts are electrically bonded and the entire system is properly grounded, the static hazard will be minimized. However, as it was observed during the tests that the dust discharged into the air carried a static charge even when the ducts were electrically bonded and grounded, it is important that outlets of blower systems for the removal of dust, lint and vapor should be located away from combustible material.

*See N.F.P.A. Regulations for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal.

Fire Tests of Mineral Wool Insulation.

Tests to determine the fire resistance of wood-frame partitions which have the space between the studs and the facings filled with mineral wool have been made by the National Bureau of Standards. It is expected that the results of these tests will be used to increase the fire resistance of such partitions without changing the material or thickness of the facings.

The tests indicated that the filling of wood-stud partitions results in a substantial increase in fire resistance, but that care must be taken to avoid uneven filling. It was found that some of the methods of filling used in these experiments left spaces through which the fire spread to the unexposed side of the partition.

For the tests, the partitions were built into movable frames and were placed to form one wall of the furnace chamber. Most of the partitions were tested under load for endurance against fire. Fire and hose stream tests were carried out with those constructions that withstood the fire endurance test for one hour or more, and which met the requirements for that length of time.

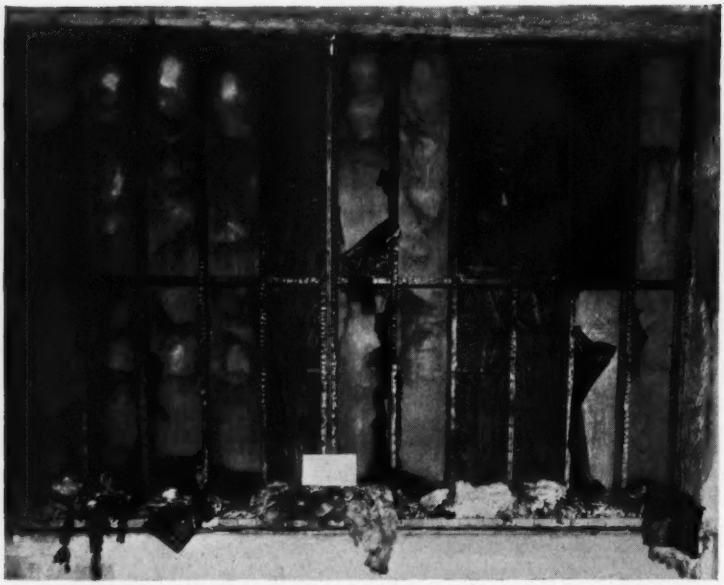
A summary of the results, reported by 15-minute intervals, is shown by the table given below.

Results of Fire Tests of Wood-Stud Partitions Filled with Mineral Wool.

Material	Facing		Filling		Fire-endurance Period	
	Thickness of plaster or board	Plaster mix	Form	Weight lb./ft.²	Bearing	Non-bearing
T & G 3-in. wood ceiling boards	¾ in.	—	Bulk, tamped...	6.9	¼ hr.	¼ hr.
T & G 3-in. wood ceiling boards	¾	—	Bulk, loose.....	2.7	¼	¼
T & G 3-in. wood ceiling boards	¾	—	Bulk, hand-packed	2.6	½	½
Wood lath, lime plaster.....	½	1:5 1:7½	Pellets, blown in.	2.2	—	¾
Gypsum board.....	½	—	Bats, not nailed.	0.6 to 1.2	¾	1
Gypsum board.....	½	—	Bats, nailed....	.6 to 1.2	1	1
Wood lath, gypsum plaster....	½	1:2 1:3	Bats, not nailed.	1.0 to 1.3	1	1
Wood lath, gypsum plaster....	½	1:2 1:3	Bats, nailed....	1.0 to 1.3	1	1
Metal lath, gypsum plaster....	¾	1:2	Bats, ⅔ nailed..	1.0 to 1.3	1½	1½
Metal lath, gypsum plaster....	¾	1:1	Bats, ⅔ nailed..	1.0 to 1.3	1½	1½

Results for the non-bearing classification are based on ability to prevent an average temperature rise of 250° F. on the side not exposed to the fire, or a

NOTE: This article has been abstracted from a report which appeared in the *Technical News Bulletin* of the National Bureau of Standards.



Exposed side of wood stud partition faced with ½-inch gypsum wall board and filled with mineral wool bats after ½ hour exposure to fire and 2 minutes 24 seconds application of a fire hose stream.

rise of 325° F. at any point, to prevent the passage of flame, and to prevent ignition of cotton waste placed against the unexposed side. Results for the bearing classification are based on all these criteria with the addition of a requirement that the partition must have the ability to sustain a design load of 358 pounds per square inch of the net area of the wood studs for the period of exposure to the fire.

In the first two tests shown in the table, the loose rock wool was dropped into the stud space to a height of 4 ft. It was tamped with a sash weight in the case of the first test, and lightly packed with a stick for the second. Both these tests failed because boards on the unexposed side were ignited at points where there were voids in the fill. The results in these two cases differed little from results obtained with a similar partition which had not been filled. In the third test the fill was placed progressively as the facing was applied, resulting in a fill of more uniform density.

For the partition faced with lime plaster on wood lath, the fill was placed by pneumatic means after the partition was built and aged, the equipment used being typical of those applied in placing wall and attic insulations. Apparently in this case also the failure was at a void or sparsely filled location in the fill. The partition, however, withstood the test for 16 minutes longer than a

Exposed side of wood stud partition faced with gypsum plaster on wood lath and filled with mineral wool bats after ½ hour exposure to fire and 2 minutes 24 seconds application of a fire hose stream.

similar unfilled partition. Some additional tests with wood lath and plaster partitions with mineral wool fill in bat form are now in progress.

The mineral and glass wool bats applied as fill in the remaining tests were of the usual wall-thick types used for house insulation, with waterproof paper on one side. They were 15 inches wide and 23 to 48 inches long, and were placed against one facing for the full height of the partition before the other facing was applied. Where secured by nailing, 8-penny finishing nails were driven on 12-inch centers through both ends of the bats into the middle of the sides of the studs. The densities given apply for the nominal area of the bats. As compressed into the stud space the density would be about 10 per cent higher, or equivalent to about 2.2 lbs. per cubic foot for glass wool and 3.6 to 4.7 lbs. per cubic foot for rock and slag wool.

The filling increased the fire resistance of the construction with the ½-inch gypsum board facing by 10 to 20 minutes, for that of gypsum plaster on wood lath by 25 to 30 minutes, and for that of gypsum plaster on metal lath by about 30 minutes. The proportions given in the table for the plaster mix are in terms of weight of gypsum plaster or dry hydrated lime to dry weight of sand. Where two ratios are given, the first is for the scratch coat and the other for the brown coat. The Potomac River sand used has a high content of quartz and chert. Where a white finish was applied, its thickness is included in the given thickness of facing.

The tests indicated that the filling of wood-stud partitions results in a substantial increase in fire resistance. The filling apparently retards the transmission of heat to the unexposed facing and decreases the rate of burning of the wood supports. However, care is needed to obtain a fill without voids. Apparently this condition is more often attained with fills in bat form placed before the last facing is applied than with fills placed after both facings are in place. The former method also affords opportunity for inspection. Even with this type of construction, however, care must be exercised if results comparable to the ones given here are to be obtained. The truth of this is brought out in cases where the facing on the side exposed to the fire distintegrates or falls off relatively early in the test. Then, if the filling has been nailed in place, or held by equivalent means, added fire resistance is obtained. This is true, although to a less extent, even if the facing on the side exposed to the fire does not fall off or disintegrate.

Pennsylvania Distilling Co. Fire.

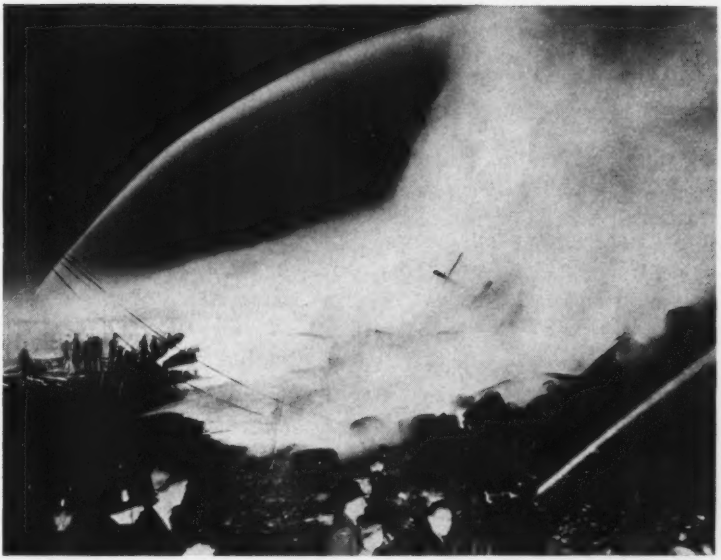
Report by Eastern Underwriters Inspection Bureau,
(Member N.F.P.A.).

Fire destroyed a rack warehouse and a cistern building at the Pennsylvania Distilling Co., Inc., plant at Logansport, Pa., on the night of May 5, 1939, with a loss of over $700,000. Presumably discovered while small, the fire burned for an hour and a half after the first volunteer fire company arrived before anyone with authority could be located to give the firemen permission to enter the Government-bonded warehouse. By that time the fire was beyond control. Considering the isolated location of the plant, inadequate preparations for fire defense, and delay in beginning fire fighting operations, it is fortunate that firemen were able to prevent the destruction of the entire plant.

Construction and Occupancy.

The whiskey distillery at which the fire occurred is at an isolated spot in the foothills of the Allegheny Mountains, several miles from the nearest town. Most of the plant, including the warehouse in which the fire started, was erected about 1900. The main group of buildings covered a plot 460 feet long and 85 feet wide. It is made up of a still building with boiler house and drying building to the north, and the fermenting building, cistern building, warehouses A and B, and the bottling building at the south. Warehouses C and D were detached more than fifty feet to the east. Railroad tracks between the plant and the Allegheny River are elevated slightly. This made the river difficult to approach for pumper suction.

Warehouse B, in which the fire started, was one equals six stories in height, with brick walls, joisted roof and single board joisted floors at second



♦ *International.*

While firemen waited for permission to enter a Government-bonded whiskey warehouse at the Pennsylvania Distilling Co., Inc., plant at Logansport, Pa., fire gained such headway that the warehouse and an adjoining bottling house were destroyed, with a loss estimated at $700,000.

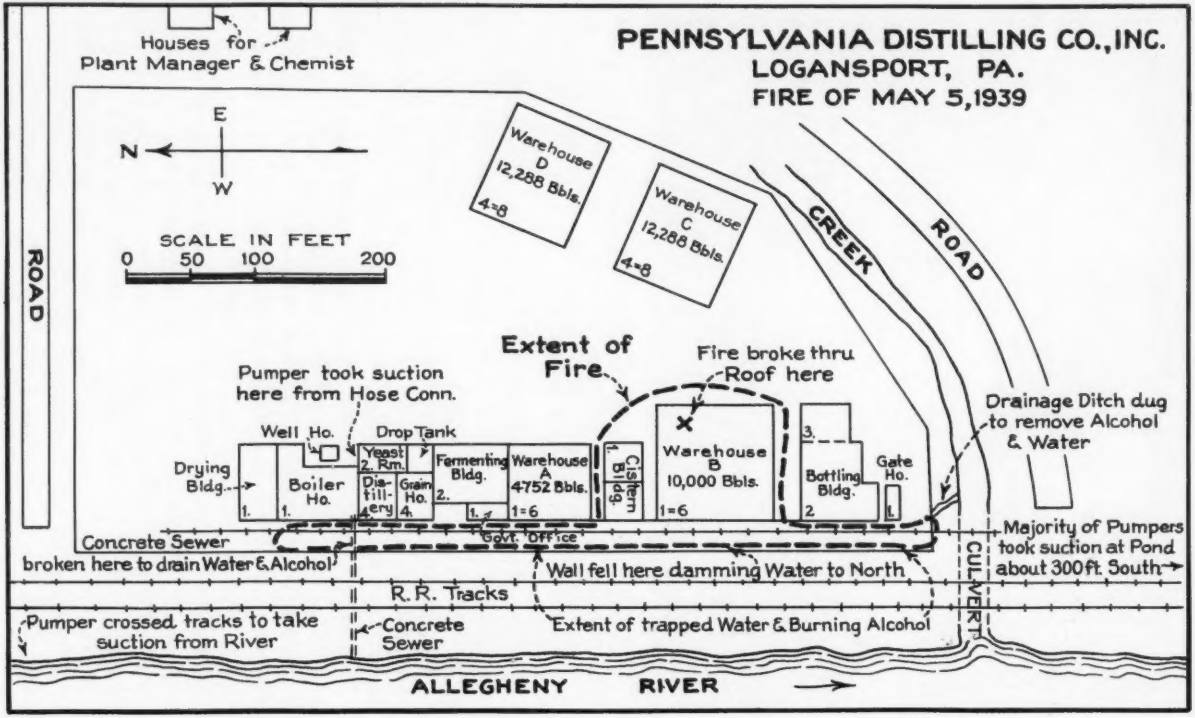
and fifth floor levels. The building covered an area 85 ft. by 85 ft. Barrels were stored in the usual rack structure running 56 ft. to roof. Racks were tied to walls by joists supporting the aisles. Stairs and elevators were open to the roof. The warehouse was rated at 10,000 barrels capacity and is understood to have contained more than 10,000 barrels of bonded whiskey, mainly three to five years old, at the time of the fire.

The destroyed cistern building was a one-story brick-joisted structure 61 by 30 ft. located between Warehouses A and B. It was being temporarily used for storage of empty bottles, as the plant was not operating at the time of the fire because all warehouses were completely filled.

Story of the Fire.

On the day of the fire, all warehouses had been visited by U. S. Government men, and plant employees, who took samples of whiskey. The warehouses were closed and locked for the night about 4 P.M. The watchman began his hourly rounds at 7:30 P.M., but did not enter the warehouses.

About 9:20 P.M. the watchman discovered smoke coming from ventilators of Warehouse B. He notified the plant chemist living near by. The chemist telephoned the fire departments of Ford City and McGrann, who


PENNSYLVANIA DISTILLING CO., INC.
LOGANSPORT, PA.
FIRE OF MAY 5, 1939
Houses for Plant Manager & Chemist
E
N
W
SCALE IN FEET
0 50 100 200
ROAD
Warehouse D 12,288 Bbls. 4-8
Warehouse C 12,288 Bbls. 4-8
CREEK
ROAD
Extent of Fire
Fire broke thru Roof here
Pumper took suction here from Hose Conn.
Drainage Ditch dug to remove Alcohol & Water
Well Ho.
Drop Tank
Drying Bldg.
Boiler Ho.
Yeast & Rm.
Distillery
Grain Ho.
Fermenting Bldg.
Warehouse A 4752 Bbls.
1=6
Cistern Bldg.
Warehouse B 10,000 Bbls.
1=6
Bottling Bldg.
Gate Ho.
Concrete Sewer broken here to drain Water & Alcohol
Govt. Office
Majority of Pumpers took suction at Pond about 300 ft. South
Wall fell here damming Water to North
R.R. Tracks
Pumper crossed tracks to take suction from River
Concrete Sewer
Extent of trapped Water & Burning Alcohol
CULVERT
ALLEGHENY RIVER

arrived in about twenty minutes. The Ford City firemen brought a pumper, but being unfamiliar with the surroundings they could locate no water. The Allegheny River was considered inaccessible due to the high bank and the railroad line. They first connected to hose outlets of service lines, but could get no water, as the line was shut off at the time.

Bonded Warehouse B was locked with a U. S. Government lock. The employees would not assume the responsibility of opening the warehouse and refused to let the firemen enter. In the meantime the chemist was trying without success to locate Government agents to get permission to enter the warehouse. Accordingly until after 11 P.M. the fire companies stood by without fighting the fire. Finally a Government agent arrived and opened the warehouse to permit the start of fire fighting operations.

A man was put at the telephone to ask aid from all near-by communities. Seventeen volunteer fire departments responded with twelve pumpers and other apparatus. Although smoke masks were used, the dense smoke drove out the firemen after they had reached the third floor level without locating the actual fire. It was impossible to reach the roof of the building to ventilate the structure, as the needed aerial ladder called from New Kingston, Pa., was misdirected and did not arrive until 12:15 A.M. Just as this apparatus was being placed in action, the fire broke through the northeast corner of the roof, some three hours after it was discovered. Before the fire broke through the roof a pond where pumpers could take suction was located four hundred feet south of the plant. The larger pumpers pumped directly to the fire, while the smaller ones were placed in relay. One pumper managed to get over the railroad embankment to take suction from the river. Another pumper took water from the plant service mains after the valve was opened.

It was soon evident that Warehouse B was lost, so efforts were directed to flooding walls and roofs of near-by buildings. All sewer outlets to other buildings were plugged. There were six streams east of the fire, one on the roof of Warehouse A and two at the west side of the fire.

About 1:15 A.M. the northeast corner of Warehouse B collapsed and the cistern house became involved. The racks remained in position and burned after the collapse of the walls. Fortunately the south wall held much longer and protected the Bottling House.

During the fire burning whiskey on top of the water was trapped along the west side of practically the entire length of buildings by the railroad embankment. This was drained by digging a ditch at the south end to a near-by creek. The collapse of the west wall of the warehouse dammed up the water north of the fire and it was necessary to withdraw several hose streams so that burning whiskey would not flow on top of the water over sills into other buildings. Finally a fireman, protected by hose streams, succeeded in smashing with a sledge the top of a concrete drain leading to the river. This took

care of the water and escaped alcohol, although burning alcohol had to flow past several buildings to reach the drain.

The fire was very spectacular, with flames mounting high in the air. It was not brought under control until 6 A.M. and service lines were kept on the ruins twenty-four hours longer. The whiskey burned on the river over a considerable area, but did no damage, due to the isolated location of the plant.

Cause and Loss.

The cause of the fire is unknown. No repair work had been done in the warehouses for some time. No leaking barrels had been noted at inspection by plant employees. Heat had been turned off for some days. Electric wiring was in good conduit. Cleanliness was unusually good and smoking well controlled.

The loss is estimated at $700,000. Warehouse B and the Cistern Building were completely destroyed. The south wall of the Bottling Building was cracked and is out of line. The roof and penthouse on Warehouse C were badly scorched. Windows and woodwork along the entire west side of the main plant were damaged. Considering the delay in starting fire fighting, it is fortunate that the entire plant was not involved.

Conclusions.

The hesitation on the part of the fire departments and employees to break the locks on the warehouse was a critical factor in this large loss. Since the fire, assurances have been received from the U. S. Office of Internal Revenue as follows:

"The statute relating to the establishment of internal revenue bonded warehouses provides that they shall be under the joint custody of the storekeeper-gauger and the proprietor thereof, shall be kept securely locked, and shall at no time be unlocked or opened except in the presence of the storekeeper-gauger or other person who may be designated to act for him.

"Laws must be given a reasonable interpretation, and there is no law known to this office to prevent representatives of fire departments summoned to a fire at an internal revenue bonded warehouse from forcing the Government lock on the outside of the building, in the absence of the storekeeper-gauger, for the purpose of entering to extinguish the fire.

"In such an emergency, the proprietor of the bonded warehouse, or his agent, would be expected to notify the storekeeper-gauger assigned to the plant immediately, by a special messenger if necessary, await his arrival at the premises, and render such assistance as the storekeeper-gauger might require."

Records Office Fire, Providence, R. I.

Some seventy or eighty employees in an office of one of the new U. S. Government agencies on the top floor of the five-story Starkweather and Shepley Building in Providence, R. I., were endangered on the morning of May 25, 1939, when forty thousand transparent pyroxylin envelopes containing individual case records became ignited. One woman trapped in a lavatory was severely burned when she ran through flames to reach the main exit. Two other women remained in the room and were carried down an aerial ladder by firemen. Forty-two automatic sprinkler heads operated promptly and doubtless prevented a major disaster, as the fire area was only a few feet from the main exit. The fire was presumably due to the careless smoking of an employee.

Construction and Occupancy.

The office building in which the fire occurred was a five-story brick structure with heavy plank and timber floor and roof construction. The building has a frontage of seventy feet and a sixty foot depth and is accessible on three sides by streets and alleyways. There is an open stair and an elevator shaft at the east end of the structure. The top three floors were occupied at the time of the fire by Government offices having about 150 employees. The two lower floors were occupied by insurance company offices.

The fifth floor, on which the fire occurred, is seventeen and one-half feet in height, with windows on three sides and with an open outside balcony type iron fire escape leading to the alleyway at the end of the building opposite to the main stairway.

Along the north and south sides of the fifth floor, above the windows, are interior balconies of frame construction with one open wooden stairway leading to each balcony. The balcony on the north side was used to house records in metal transfer cases. The space below this balcony is partitioned to provide three private offices. The balcony at the south side was used as a cloak room for employees and has a wooden storeroom enclosure at one end. This balcony was unoccupied at the time of the fire. The fire started directly beside the only exit from this balcony. The space under this balcony is part of the general office area.

The entire building, including the fire floor and under-balcony areas, is well protected with a wet pipe automatic sprinkler system supplied from a six-

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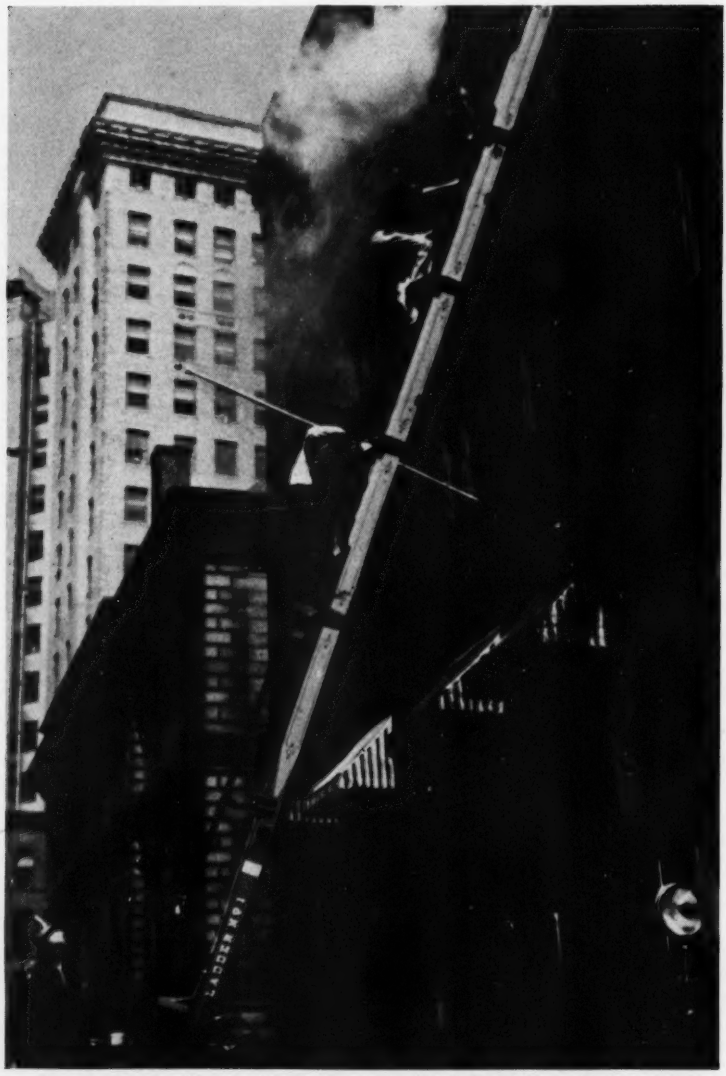
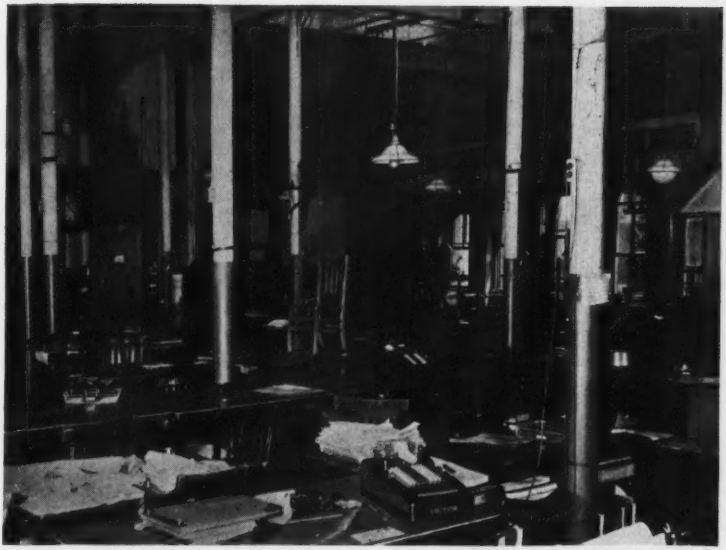
NOTE: This report is based on information supplied by the Fire Prevention Bureau of the Providence Fire Department, supplemented by an inspection of the fire premises by the N.F.P.A. Department of Fire Record.



Two women employees of a Government office in Providence, R. I., are shown being assisted down an aerial ladder when trapped in a fifth floor room by the burning of 40,000 pyroxylin record envelopes. A third woman was severely burned when she rushed through the flames to escape, before firemen arrived.



Congestion in the fifth floor office of a Government agency in Providence, R. I., was nearly twice the maximum under the N.F.P.A. Building Exits Code. But for the quick operation of forty-two sprinklers, the burning of 40,000 pyroxylin record envelopes might have caused considerable loss of life. The location of the fire may be seen in the center background near the only exit from the balcony cloakroom and the women's washroom. The main exit from the office was under the clock shown at the left.

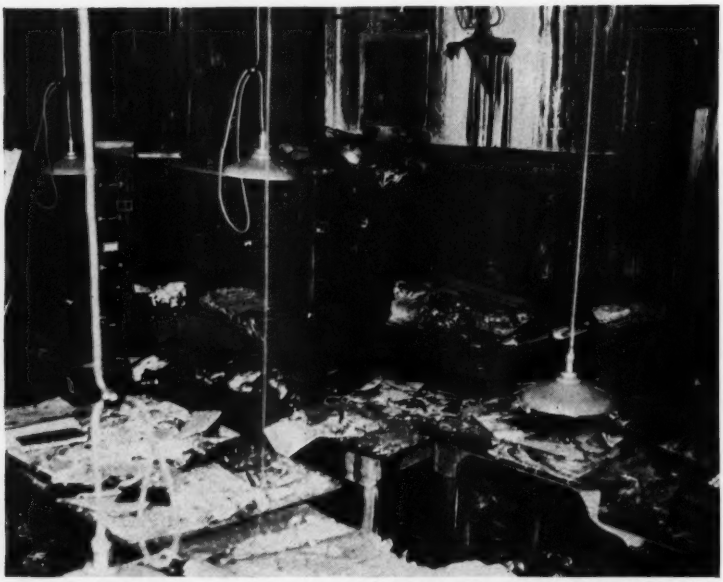
inch low service public water main which had a static pressure at the street of about ninety pounds at the time of the fire.

Story of the Fire.

The fire occurred at the southeast corner of the fifth floor, not far from the main exit. An employee had taken five metal file drawers out of their cabinets and placed them on a table near the stairs from the south balcony and adjacent to the door to the women's washroom. These filing drawers contained card records, four by six inches in size, each in an individual pyroxylin envelope. The envelopes permitted reading of both sides of the card without removing from the envelope. The metal filing cases housing the balance of 40,000 similar records were near by.

The fire occurred suddenly at 10:30 A.M., when some of the pyroxylin record envelopes were ignited. The fire quickly involved the contents of the file drawers on the table and spread to the contents of the filing cabinets housing the balance of the pyroxylin envelopes.

With the first flash of flame the occupants of the floor rushed out of the office and down the main stairway. Their escape was aided by the almost immediate operation of forty-two sprinkler heads, which retarded the flame and



Individual pyroxylin envelopes containing 40,000 card records were housed in the metal filing cabinets shown, and several drawers of records were out on tables. The door to the washroom, in which three women employees were trapped, may be seen at the extreme right. One of these women was badly burned when she rushed through the fire to the main exit. The others were taken down an aerial ladder.

absorbed much of the heat. Also the unusually high ceiling undoubtedly facilitated the escape of the occupants by permitting the heat to dissipate somewhat. Although no exact information is available, it is apparent that few, if any, of the occupants of the fire floor used the outside fire escape. However, some of the men employed on lower floors did use the escape, although not actually endangered by the fire.

Had the one woman who was severely burned in escaping from the washroom remained in the room, she would have been saved by firemen along with the two other women in the room. When she opened the door to escape, the heat set off a sprinkler inside the washroom, which wet down the other women in the room.

Due to the efficient action of the sprinklers the fire department did not use any hose streams, although two lines were charged and ready for service. Employees in the insurance offices on the lower floors did good work in preventing water damage by spreading forty-one salvage covers provided by the fire department. Ventilation of the fire area was accomplished by breaking the wired glass in the skylight nearest to the fire. The pyroxylin record envelopes and their contents were almost entirely consumed by fire and the metal

filing cases were badly damaged. There was some charring of the ceiling immediately over the fire. Otherwise there was little fire damage other than the blackening by smoke of the walls and ceiling in the immediate fire area.

Cause and Conclusions.

Officials in charge of the Government agency suggested the possibility that sun's rays through a skylight had started the fire. This does not seem likely, however, because the fire occurred in the morning and the skylights were well to the west of the fire area. In addition several persons reported that there was smoking near the table where the records were being used.

It is obvious that the occupants of the office where the fire occurred failed to appreciate that there was any hazard involved in the use of large quantities of pyroxylin envelopes or in exposing a large number at one time. The Government purchasing agent did not know that the envelopes would burn, and stated that they would discontinue their use. Although several firemen complained of sore throats due to inhalation of pyroxylin fumes, no serious complications have been reported due to the fumes. Fortunately the destroyed records were duplicated on another floor of the same building, so that no serious interruption of routine has resulted other than that usual for repairing and repainting the fire area.

This office was extremely congested. Desks and filing equipment were very closely spaced, with much less than the usual office aisle space. Reports vary as to the number of employees on the floor when the fire occurred, but it was generally agreed that the total number present was between 70 and 80. This would indicate a density of population nearly double the maximum density established in the N.F.P.A. Building Exits Code as a result of many counts of ordinary office occupancies. The Building Exits Code on the basis of such counts assumes the maximum density of ordinary office occupancy at one person per 100 square feet of gross floor area, and specifies exit facilities on the basis of a population determined in this way, unless otherwise established. In view of the fact that the population on this floor was practically double the usual maximum in an office occupancy, the fact that no lives were lost is even more remarkable.

School Fire, Pipestone, Minnesota.

By Fire Underwriters Inspection Bureau,
(Member N.F.P.A.).

A fire believed to have originated in the ventilating system pent house caused a loss estimated at $150,000 in the fire-resistive public grade and high school building in Pipestone, Minnesota, on March 17, 1939. Non-standard ventilating ducts and flues were the medium through which the fire spread throughout the building. The fire was not controlled until a false wooden roof over the main building had been destroyed. Due to an efficient fire drill, 1200 students and 47 teachers left the building promptly and in an orderly manner.

Construction and Occupancy.

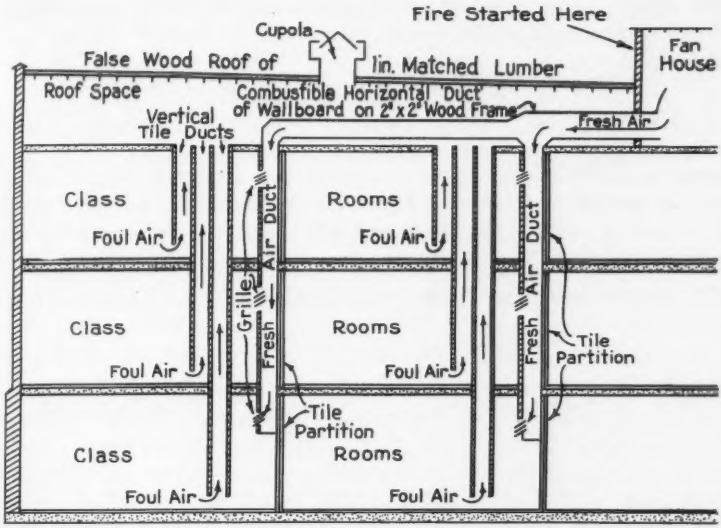
The school building, erected in 1918, is of three-story fire-resistive construction, with walls of hollow tile faced with brick. All floors and the third floor ceiling are of reinforced concrete joists, tile filled, on reinforced concrete supports. A false wooden roof was constructed of one inch matched boards on wooden joists, surfaced with built-up tar and gravel covering. The first and third floors of the building housed high school classes and the second floor housed grade school children.

A pent house of hollow tile construction with ordinary wood joisted roof was used for housing ventilating fans and motors. Horizontal fresh air ducts throughout the roof space were constructed of combustible wall board on two by two-inch wooden frames. Vertical fresh air ducts direct to each room were enclosed in hollow tile and gypsum blocks with a metal grille on the openings to each room. Vertical foul air ducts of similar construction exhausted into the roof space. There were no dampers at any point in the foul air ducts and no grilles on openings from the rooms.

Story of the Fire.

School was in session the day of the fire when, about 11 A.M., the janitor observed smoke coming from a fresh air grille in the first floor hallway. He went to the pent house to investigate and found a fire at the head of the stairs adjacent to the large ventilating fan. Returning to the second floor he sounded the fire alarm and directed that the fire department be called. He then returned to the pent house with a 2½-gallon chemical extinguisher, but was unable to cope with the rapidly spreading fire. Failing to subdue the fire, he attempted to reach the control room to shut off the fans, but was unable to do so because of the heat.

The students and teachers left the building in approximately two minutes, using three stairways and two fire escapes. Afterward the men teachers and some high school boys were sent back to remove wraps.



Substandard arrangement of the ventilating system played an important part in the $150,000 loss in the public school at Pipestone, Minnesota. Combustible fresh air ducts from the fan house spread the fire through the roof space. As vertical air ducts were without dampers and terminated in the roof space, the fire readily spread downward through the ducts to all floors of the building.

The volunteer fire department responded with a pumper, service ladder truck, a chemical truck and a total of forty men. When the fire department arrived, the combustible roof structure was partially ablaze and although current to the ventilating fans had been shut down, the building was well filled with smoke. There was also fire in the third floor library caused by flames from the fresh air duct. Books and book racks provided ready fuel and considerable damage was done in this section. Other small fires were caused throughout the building due to flaming materials from the roof dropping down the air ducts, but fortunately lack of combustible materials near the grilles prevented the fires from attaining serious proportions.

The fire department used two pumper streams and one hydrant stream on the roof fire with little success, although water seriously damaged all floors of the building. By 11:45 A.M. the roof structure was entirely in flames, and calls were sent to Luverne, Minnesota, 26 miles distant, and Flandreau, South Dakota, 19 miles distant, for aid. Each department responded with a pumper. By this time the reason for fires in all sections of the building was discovered, and men were assigned to the vent ducts for falling embers and the small fires were extinguished with hand chemicals, standpipe hose and fire department hose streams. The most serious of these fires was discovered at 12:45 P.M.,

when burning embers dropped into the janitor's supply room, causing severe damage to the room, hallway and stairway in this section before it was extinguished.

Extent of Damage and Conclusions.

The wooden roof structure and all ventilating equipment and machinery in the pent house were destroyed. The metal roof trusses over the library were warped and twisted. The third floor ceiling slab was spalled considerably and partially warped. Many third floor partitions were badly cracked and the wood floor surfacing was warped. The second floor was damaged by water. In many rooms the tile in the floor slab spalled from water damage and wood floor surfacing was damaged. On the first floor the principal damage was from fire in the southeast corner which gutted several rooms and damaged the hallway doors. Smoke and water damage was considerable on the first floor and in the auditorium.

The combustible ventilating ducts in the roof space were responsible for the rapid spread of the fire. Had these ducts been of incombustible construction, as specified by the N.F.P.A. regulations on air conditioning and ventilating systems, it seems likely that the flames would have been largely confined to the fan house, although smoke might have passed through the ducts to the rooms. The second serious deficiency in the design of the ventilating system was that ventilating ducts from the various rooms opened into the combustible attic space. In addition there were no dampers to prevent the passage of smoke and fire through the ducts.

This fire again illustrates the folly of wooden roof construction over an otherwise fire-resistive building. The large amounts of water required to fight the fire in the roof space and in the various rooms contributed to the large loss.

The importance of well-disciplined fire exit drills is also shown by this fire.

School Explosion, Barberton, Ohio.

Fifty-two children and four school employees were injured when natural gas explosions wrecked a former dwelling in use as a temporary public school at Barberton, Ohio. The blasts occurred at 1:30 P.M. on May 31, 1939, the day before the end of the school session. More than two score of victims were confined to the hospitals after the disaster and several were critically injured. It is considered fortunate that the disaster did not claim many lives. A small fire which started in the ruins was quickly extinguished.

Construction and Occupancy.

The two-story frame building in which the explosion occurred was formerly a dwelling which, with other near-by property, was purchased as part of a school expansion program. On the site, this summer, is to be erected a new Central Graded School which will also house certain high school departments. Pending the erection of the new building the dwelling was being used as temporary quarters for 101 students in classes 1A, 1B and 2B of the Central Graded school. Practically all of the children were either six or seven years old. Three teachers and the janitor were also in the building and were among the injured.

Story of the Explosions.

The school janitor was preparing to burn some papers in the furnace. When he struck a match to light the papers a natural gas accumulation in the basement exploded with a roar. Two distinct explosions occurred at a very close interval. The first explosion seemed to raise the building from its foundation, throwing pupils from their seats and shattering walls and partitions throughout the structure. The second blast followed immediately and blew out the entire north end of the building and destroyed the floors. The weakened and swaying structure threatened to collapse on the injured children. Children were struck by flying glass and débris or were thrown into the wreckage of desks and sections of walls and ceilings. A few children received burns, as a corner of the building ignited from burning gas.

The force of the explosion seemed to center under the room occupied by Class 1B located on the ground floor. The teacher and most of the children in the room were injured. Fortunately the central walls of the building remained largely in place and supported the roof. The second floor was held up in the center of the building, but fell downward where the outside walls were detached

NOTE: Various official investigations of this accident are in progress, but official findings have not been released. This account has been prepared from the best information available prior to the publication of the QUARTERLY.

Acme.

This former dwelling in Barberton, Ohio, was in use as a temporary public school housing 101 students when wrecked by a gas explosion on May 31, 1939. Fifty-two children and four school employees were injured sufficiently to require hospital treatment. The second floor was dropped to the ground level, where outside supporting walls were blown out.

by the blast. The second floor thus acted as a slide which threw the upstairs children outside of the building with only minor injuries.

At the sound of the blast neighbors and workmen on the near-by school construction job rushed to rescue the children. Two city fire trucks arrived quickly, but most of the children were already on their way to hospitals when firemen reached the scene.

Fire in one corner of the building, ignited by the escaping gas coming from the basement wall, was quickly extinguished, although the gas flame was not put out until the gas supply was shut off at the curb.

Considerable confusion resulted as some of the children, who were blown from the building but not seriously hurt, rushed toward their homes, and parents, learning of the blast, hurried to the local hospital to find their children.

Cause of the Explosion.

City authorities began an immediate investigation to determine the cause of the blast. No gas had been used in the building since the school authorities took possession last January, and the gas service was shut off at the meter.

Workmen dug down to the gas service pipe between the building and the sidewalk and discovered a break in the pipe about eight feet from the building

wall. This led to the belief that gas had escaped from the break and followed the pipe into the building. Authorities pointed out that failure of the pipe may have resulted when a sewer excavation was made close to the pipe.

Conclusions.

The natural gas involved in the explosion was not odorized, as it was considered to have enough natural odor to give reasonable warning in the event of a leak.

Although several persons were seriously injured in the explosion, it is considered fortunate that a great loss of life did not occur. Had the building been of some more substantial form of construction, which might have confined the force of the blast and provided heavier débris, it seems likely that a heavy toll of life would have been taken.

It is also fortunate that a serious fire did not occur before the injured were removed from the wreckage. Nevertheless, the occurrence should serve to emphasize the dangers of placing small children in unsuitable school quarters and the importance of taking every possible precaution to insure safety when the use of temporary school facilities is unavoidable.

Wall Paper Steamers.

In recent years a gasoline burning device known as a wall paper steamer has figured with increasing prominence as a home fire hazard. While there are probably not many of these devices in any one locality, it is a growing practice on the part of hardware stores, wall paper stores and others to rent these steamers by the day to the general public. One steamer may thus bring a large number of lives and dwellings within range of its hazards.

The burner used in wall paper steamers is similar to that used in plumbers' blow torches and furnaces. The difference in fire hazard is largely in the inexperience of persons using the equipment. Plumbers' gasoline stoves are usually used by men who are fully experienced in their operation. Wall paper steamers are operated by all sorts of people who are not wholly familiar with the hazards of gasoline and know nothing of safety precautions in the operation of gasoline burning equipment. Therefore, even if the machines were technically safe, the handling of gasoline and use of open flames in homes, which their use would entail, would present a serious hazard. Rigid observance of the safety rule that the fuel tank be filled only out of doors and by daylight has not been possible to obtain in cases of other gasoline pressure stoves and lamps, and there does not seem to be a better chance with this equipment. Universal good practice in locating stoves where they will not ignite combustible materials is incompatible with portable stoves moved about with more regard to convenience than to safety.

The wall paper removers are made by several manufacturers. All operate on the same general principle. A typical steamer assembly consists of two main parts: a stove and a steam boiler. The stove consists of a fuel tank, vaporizer and burner unit with a hand pump for creating pressure in the fuel tank. The boiler unit is a simple water tank with filling and steam hose connections. Often a simple safety valve, intended to release the steam before it reaches sufficient pressure to burst the tank, is provided. The steam is applied to the wall paper through a hose and a sieve-like applicator. It saturates and loosens the paper so that it may be easily pulled or scraped off.

Fires caused by or originating in such devices have had the usual serious aspect of gasoline fires, often inflicting serious burns on the operator. They have been diverse in the failures which have caused them. The N.F.P.A. Department of Fire Record has reports of several fires in this type of equipment which serve to indicate the prevalence of the hazard. Due to the difficulties in compiling dwelling fire records, there has been no record of wall paper steamer accidents made for the whole country. City fire departments, however, have noted experience with such machines in their own areas. The fire department of Columbus, Ohio, in particular became interested in such equipments and in 1937 segregated fires due to them. Eight fires, two of which were fatal, were laid at the door of the gasoline fired wall paper steamer. Seven of these fires, one of which was fatal, were caused by the human failures which may be expected from operators who are not experienced in the safe operation of such devices. Several resulted from filling tanks while burners were operating. In other cases the operator was guilty of such carelessness as tripping over an open can of gasoline. Such experiences have nothing to do with the design of the machines along technically safe lines, but are properly regarded as caused by hazards of the devices.

The other Columbus fire during the period studied was an equipment failure. Either due to too heavy a hand on the pump or the gasoline in the supply tank being heated, the tank suddenly exploded, blowing flaming gasoline all over the room where it was operating and burning to death the man who was operating it.

On April 25, 1939, the Columbus equipment failure was duplicated in a two-family Worcester, Mass., dwelling. This time there were survivors to tell the story. A paper hanger was steaming wall paper with a rented machine. He refilled the tank, spilling some gasoline on the base plate. This gasoline was ignited and burned with characteristic violence. The paper hanger went to get a piece of carpet to smother the flames, but before he could return the pressure had increased in the tank enough to blow out the fuel gage and spread the burning gasoline around the room. The fire spread through the house, trapping one woman who jumped from a window, fatally burned.

Explosions of wall paper steamers in Chicago and Toledo, Ohio, during 1937 caused serious injuries to two persons in each instance and started fires which did considerable damage. In the Toledo case the investigator reported that the explosion originated in the carburetor of the machine. In the Chicago accident the explosion was followed by a fire which drove fifty to a hundred people out of the apartment house in which it was being used.

In Cleveland, Ohio, another fire originating in a gasoline fired wall paper steamer was the result of a different type of equipment failure and was nearly fatal to the operator. He had rented the machine from a hardware dealer. This particular equipment did not have a built-in pump. Pressure in the supply tank was provided by a separate unit pump, which was attached to the tank through a back pressure check valve. The check valve was built into the filler cap and while pumping the opening was sealed by the pump shaft itself. The man operating the device had in this case just finished increasing the pressure by pumping the tank up to the required 30 pounds. When he removed the pump, the check valve did not operate and a stream of gasoline, instantly ignited by the burners, shot from the opening straight into his face. A neighbor happened by as the victim jumped through the window. He used his overcoat to extinguish the fire in the operator's clothing. Sixty-one days in the hospital and nine months convalescence was the toll of this fire.

These items are but short chapters in the macabre history of the wall paper steamer. They are the fires due to these devices that have been reported in sufficient detail for particular hazards to be recognized. There are also reports of "home-made" equipments of this type which use a cast iron kettle covered with a soldered top as a fuel tank. The burner, a few inches above the solder, has sometimes supplied enough heat to melt it and allow the gasoline vapor to escape.

Executive Office correspondence with fire chiefs and fire marshals who have had experience with gasoline burning wall paper removing devices indicates their opinion that, while technically safe equipment of this type could be made and would doubtless reduce the hazard to a considerable degree, the use of any such gasoline burning appliance with the attendant storage and handling of gasoline is too great a hazard to allow in any dwelling. The latest development in wall paper removal by steam is a new device which burns fuel oil instead of gasoline. It is expected that the hazard of this equipment may be less severe than that of the gasoline pressure type.

Fires in Solid Front Buildings.

Fire protection engineers and municipal fire department officials are concerned over the present tendency to completely enclose buildings behind solid walls without window openings through which firemen can rescue trapped occupants or attack a fire. Obstructions of this sort take various forms. Modern fire-resistive, air conditioned structures sometimes have glass brick wall areas to permit light rather than window openings. On older structures solid panels of glass, metal or tile are provided to produce ornamental effects. In other instances equally serious obstructions are provided by completely surrounding upper floors of buildings with large sheet metal advertising signs. A recent fire at Times Square, New York City, is indicative of the difficulties that may be expected by fire fighters due to such signs. Pent-up smoke in this fire made it difficult to control, and overcame six firemen.

Even in small communities fire fighters may expect difficulties where old mercantile buildings are hidden behind new decorative fronts or advertising signs. While the upper floors of such mercantile buildings are usually merely

International.

Six New York City firemen were overcome by pent-up smoke from a two-alarm fire in the upper floors of a four-story building hidden behind large advertising signs of sheet metal construction. Firemen are shown attacking the fire from the roof and attempting to break through the signs to reach the fire.

stockrooms and do not involve any considerable life hazard, they present a serious fire fighting problem because ventilation is difficult and in many cases it is not possible to locate the seat of the fire before it has assumed considerable proportions. This is particularly serious because many fires are normally discovered by persons outside of buildings, so that fires hidden behind solid fronts are less likely to be discovered in their incipiency. For these reasons automatic sprinklers and alarm equipment are of more than usual importance where combustible building interiors have been made inaccessible by solid or false fronts.

Studio Fire at Oslo, Norway.

By Christian Hansson,
(Member N.F.P.A.)

Twenty-nine persons lost their lives in a fire which destroyed a photographic studio at Oslo, Norway, early on the morning of November 6, 1938. Although the material damage which resulted was of small importance, the tragedy brought sorrow into many homes.

Construction and Occupancy.

The building in which the fire occurred was a three-story brick building with an attic flat, where the floors and roof were of wooden construction. The ground floor was used for shops, the second and third floors for residence, while the attic flat was used both as a residence and as a photographic studio. The proprietor of the studio, to celebrate the fortieth anniversary of his firm, had invited friends and relatives to festivities at the studio, which was lavishly decorated for the occasion. Under the roof was suspended a cardboard construction with openings in it in the shape of stars, behind which a temporary light arrangement was installed, so that the whole might represent the heavens by night. The large studio was for the occasion divided into several compartments by the erection of cardboard partitions, and paper decorations were festooned everywhere. In addition, the studio had its stock of films and chemicals, so it will be readily seen that there was a large quantity of flammable material.

Story of the Fire.

At 2:25 in the morning, the Oslo Fire Brigade received information of the fire and the first engine reached the building within two minutes thereafter. The fire had spread with such rapidity, however, that before the engine arrived, four persons had jumped, their clothing in flames. These victims were immediately rushed to a hospital, but all were dead upon arrival.

Firemen of the Oslo (Norway) Fire Brigade are here shown attacking a blaze in an attic studio, which snuffed out the lives of twenty-nine merrymakers during an anniversary celebration. Careless smoking is believed to have been the cause of this tragedy.

The firemen were faced with a wall of fire, the flames shooting high above the roof. It was not possible to force an entrance into the studio, as the doors opened inward and were obstructed from the inside. When the water had done its work two hours later and it was possible to force an entrance into the room, most of the bodies were found just inside the main door, which explained why it had not been possible to open it before. It is believed that the fire started at the opposite end of the room and that all present had rushed panic stricken to the main door and thus trapped themselves in the inferno. Death probably came very quickly and it is possible that poisonous gases from the burning films and chemicals may have played a part in this. The attic flat and roof were completely destroyed and it may be that the building was damaged to such an extent that it will be condemned.

As to the cause of the fire, no explanation can be given. Suppositions are divided between a fault in the electric light installation and the use of naked light, but experts are inclined to think that carelessness in smoking may have been the cause of the fire.

The victims were identified only with the greatest difficulty and they were laid to rest with wide public sympathy. One of the funerals included eight members of one family. The majority of the victims were in the prime of life and all respected in their various circles. There is nothing to indicate that

there had been excesses of any kind which might have caused the disaster. It is to be hoped that some good will come out of this sorrowful event, by giving rise to more exacting regulations for the construction and finishing of attic flats, for the improvement of older buildings which were constructed in accordance with early building laws, and also the prohibition of hazardous occupancies such as a photographic studio in the same building with residences.

Twenty-nine persons lost their lives in this fire, which destroyed an attic photographic studio in Oslo, Norway. Victims were trapped when, in panic, they were unable to open doors which swung inward.

Steamship "Paris" Fire, Le Havre, France.

By René Moreaux.

At 10 P.M. on April 18 the 34,000-ton French Line steamer *Paris* burned in her dock at Le Havre, France. After she had been burning for ten hours the tons of water which five fire boats, the Le Havre fire department and members of the crew poured into her hull caused the ship to list sharply away from the pier, snap her steel cables and roll over on her side in the mud. The fire department continued to fight the fire in the above water section for several hours. Since observers reported the fire "under control" at 5 A.M., the overturn of the ship at 8 A.M. is attributed to lack of coördination in fighting the fire and unintelligent use of many tons of water.

The crew and fire department members were able to accomplish much salvage of removable articles during the early stages of the fire, including valuable passenger effects and a collection of French art treasures consigned to the New York World's Fair. The ship itself, valued at $2,500,000, was a total loss. The fire is believed to have originated in the ship's bakery, where oven fires had been left burning.

The following account of the fire in retrospect is abstracted and translated from a report by René Moreaux in the *Journal de la Marine Marchande* (Journal of the Merchant Marine), French publication of which he is director.

The Lessons of the "Paris" Catastrophe.

The *Paris* case may be spoken of objectively now. Though justice may continue to pile up its notes and its files, the case is definitely decided in marine opinion.

This double catastrophe: the fire, common accident, and the sinking of the ship at the dock, subject to derision, is actually the result of a long series of errors and failures. Let us examine the facts; recite them step by step from the management to the watchman. Let us take them from the beginning.

Professional Failures on Board.

On the *Paris*, as on every steamship, there is a pastry bakery. The oven fire, after being used, ought to be put out. But just as drivers of motor trucks keep their motors going because "It is easier to get away again," the bakers on the *Paris* never put out their fires because, by wasting fuel, for which the company pays, they got a little time off from work.

The commander of the *Paris*, who is an honest man, discovered this practice only at the beginning of the inquiry. He had never made a tour of that part of the ship. Yet he should have watched out for his bakery with more than usual attention, because the equipment was old and worn out. It was

going to be replaced after the next trip of the ship to Le Havre. It is a pretty state of affairs that a steamer has to burn up before her commander learns that the bakers never put out their fires.

The chief baker, the shrewd man who violated orders so that he might stay in bed a quarter of an hour longer, eased his conscience by leaving the key of the quarters at the office. Someone had been stealing his cakes. Therefore he protected them from the covetousness of his comrades by locking the door. By saving 10 or 20 cakes he saved his company from 5 to 10 francs. But by setting the ship on fire he cost it 300 million francs, for that is what it would cost to replace her. The fact that the key was in the office did not help matters, yet the average Frenchman expects those two mysterious entities, "The Office" and "The Company," to attend to everything.

The fire broke out in the bakery. Had it been discovered immediately it would have been just another incident. Sailors know very well that on ships of all the nations of the world fire prevention measures must be rigidly observed. They also know that fires need not be serious if they are caught within the first five minutes.

There are strict rules on board ship. There was on the *Paris* everything, absolutely everything, necessary to put out a fire, even one that might be criminally set. There was everything except that which is uncontrollable: the conscientiousness of the watchman. While it is certain that Cesar Franck is not a criminal, nevertheless he did not do his job. Where was he during the twenty minutes for which he cannot account? Was he, like the commander of the ship which was so tragically destroyed by fire, safely in a cabin or some out of the way place? That, however, is of no importance. The fact is, as everyone knows, the watchman did not make his round.

In his defense, if he has one, it may be noted that Cesar Franck was only a temporary watchman. He was a member of the crew. But on arriving at Havre and while in port everybody looks for a substitute. He replaced someone who had been given time off. His fateful round was his tenth. Was he thoroughly familiar with his route? This is not certain.

Reformation of Marine Regulations.

There we touch upon one of the evils of our merchant marine. Its organization reviewed, revised and added to during eighteen months of Popular Government has made of our merchant marine something unstable and inconsistent. The ship is not much better than an underground railway waiting room. The procession of those going on leave and the substitutes coming or going with their suitcases gives it this appearance.

The officer on watch on the *Paris* was a substitute. The commander was to go on leave the next day. He had had a last fire drill towards evening—perfectly successful as usual. Then he left the ship around seven o'clock

Acme.

This aerial view of the steamer "Paris" burning at her dock at Le Havre, France, was made at dawn on April 19. Shortly afterwards the tons of water poured into the hull by fire boats and the Le Havre fire brigade caused the boat to lose her stability and roll over on her side.

without leaving his address. He was only discovered at about 2 A.M. after his ship had been on fire for four hours. The commander, who was to take charge the next day, thought he was quite within his rights not to go on the bridge until then.

Therefore the *Paris,* on the evening of April 18th, was actually in charge

of an officer on watch, who was a substitute, and of Cesar Franck, fire lookout, who was also a substitute. The officer on watch did his duty intelligently and with energy, but perhaps he would have done it still better had he belonged on board. It is necessary that our mercantile seamen from top to bottom should cease to sing this childish chant: "I substitute for you, you substitute for me, we substitute for each other."

Everybody is agreed that seamen and the general staff should have leave for relaxation, but it is imperative not to continue stopping at the rights of the men and to give some thought now and then to the demands of the maritime profession and care for the ship.

Officers paired in one employment, like the commander and his second in command, should never both be off duty at the same time. At no time during the 24 hours should the ship be without a superior officer in charge.

The Failures of the Command.

Returning to the story of the *Paris*, at the time when the fire broke out (around 10 P.M.), there is satisfaction in confirming that once the alarm was given, everybody, especially the officer on watch, did his utmost to do his duties a little better than usual. It is well that one should know that. It is one consolation in such distressing circumstances. The personnel of the engine department in particular showed an attitude above all praise.

But from the beginning there was confusion due to the fact that there was no one person in authority. In dock, as at sea, the commander of a ship is absolute master, having all responsibility. The commander of the *Paris* was lost for four hours. In his absence his powers would regularly devolve on the officer on watch. This officer was a substitute. In spite of the energy, intelligence and courage he showed, he was only a substitute for the commander and could not replace him. From 10 o'clock until 2 A.M. there was, therefore, a sort of coöperation of good intention, which tried to save the ship. The firemen from Havre went on board promptly and poured tons of water with unequaled devotion.

The result of these events shows that it is not enough, on board a ship, to put water on a fire in order to stop it. The firemen of Le Havre are always ready to carry to commanders of ships in dock their inextinguishable devotion and their excellent material, none better, but the captains should not be relieved of their responsibility of command in order to transfer it to the firemen. "If everyone does his job, the cows will be well taken care of," as the proverb says.

At last, at 5 o'clock in the morning, the fire was under control. The situation seemed to be in order. The fire would not have been more than a bad maritime incident. Yet it was after this that the real catastrophe, with its humiliation, occurred.

We are now given a host of technical explanations, telling us why the *Paris* turned over on her port side. The engineers make me laugh. It was on

the 19th of April at 5 o'clock in the morning that they should have made their explanations. It is not the past but the future which is difficult to guess.

It was a shock to the company's engineer at Le Havre. After having assisted the officer on watch by his wise counsel, he saw the fire under control and decided to go to bed. A few hours later he was awakened at his house to be told that his ship had likewise gone to bed.

There was not in that circumstance professional failure, there was only a momentary intellectual failure, due without doubt to physical fatigue. But why did not the company engineer, before going to bed, call his assistant, who was similarly charged with the welfare of the *Paris*, and therefore thoroughly familiar with the ship?

Such are the failures, moral, professional and intellectual, which resulted in a humiliating catastrophe without precedent.

Hearing Before the Mercantile Marine Committee.

On Tuesday, May 16th, M. de Chappedelaine, Minister of the Merchant Marine, was heard by the Mercantile Marine Committee of the Chamber of Deputies on the subject of the *Paris* fire. The minister paid homage to the devotion and spirit of self-sacrifice of the ship's personnel, as well as the firemen of Le Havre, who fought the fire until the ship capsized.

M. de Chappedelaine said that, from the results of the judicial inquiry and the administrative investigation, it was impossible to state whether or not the fire was started intentionally. But he brought out that, whatever may have been the cause of the fire, its extent and consequences were due to serious negligence which must not be allowed to continue. He discussed the fire at length. He emphasized the lack of organization and execution of a really efficient system of inspection, as well as some regrettable failures. He deplored the fact that, once the alarm had been given, the same precautions which are most effective at sea had not been taken.

As to the capsizing, it was the result of an accumulation of water in the ship's superstructure; an accumulation which could have been avoided if there had been better coördination in fighting the fire. After having shown certain similar faults of organization in the protection of the steamer *Lafayette*, which burned last year in Le Havre, the minister concluded by reaffirming his firm resolution to prevent a recurrence of negligence having such serious consequences. He repeated his intention to organize in all ports a rigorous system of supervision for fire protection of all ships.

Fires in Which There Was Loss of Life.

Second Quarter, 1939.

Since the publication of the April, 1939, QUARTERLY, the N.F.P.A. Department of Fire Record has received reports of 219 fires in which there was loss of life. Three hundred twenty-eight persons lost their lives as a result of these fires. During this period, the following fires were reported in the United States and Canada, which caused the loss of five or more lives each.

MARCH 7, 1939, HALIFAX, N. S. Five children were burned to death in a fire which raged through a two-family home. The cause of the fire was not determined. (L-5531.)

MARCH 26, 1939. OKLAHOMA CITY, OKLA. Eight persons were burned to death when a large transport plane crashed and burned shortly after taking off from the municipal airport at this city. Witnesses reported that the victims were trapped in the cabin and were incinerated before help could arrive. (H-43177.)

APRIL 11, 1939, CHICAGO, ILL. Seven persons, including four children, were trapped and burned to death in an incendiary fire which swept a three-story apartment building. Firemen rescued ten persons, while several others were injured in leaps from the top floor. (H-43187.)

APRIL 22, 1939, OTTUMWA, IOWA. A father and five of his children were suffocated or burned to death when fire destroyed their home. The mother and two other children were also severely burned, one of the latter dying a few days later. The actual cause of the fire is unknown, though the evidence indicates that in some manner kerosene became ignited in the kitchen, from which point the flames spread with great rapidity. The area in which this home was located lacked public water supply and other utilities because it was subject to periodic flooding. The Superintendent of the municipal water works had recommended that the city evacuate this low-lying area to avoid the more expensive installation of water mains and the restoration of damaged areas following floods. (See page 90.) (L-5532.)

MAY 11, 1939, CHICAGO, ILL. Nine men lost their lives when a dust explosion followed by fire destroyed five grain elevators. (See page 33.) (S-76410.)

MAY 27, 1939, TAMA, IOWA. Five small children were burned to death when trapped by smoke and flames on the upper floor of their home. The children were alone at the time of the tragedy. The cause of the fire was not established. (L-5533.)

JUNE 21, 1939, NEW YORK, N. Y. Eight Chinese were burned beyond recognition when an early morning fire swept two "old-law" tenements in New York's Chinatown. Several lost their lives when flames from the unprotected window openings trapped them on the outside balcony fire escapes which substituted for proper interior exits. (See page 89.) (H-43192.)

Loss of Life Fires, April-June, 1939.*

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

Class of Fire	No. of Fires	Men	Women	Children	Total
Airplanes	5	11	4	0	15
Amusement places	3	3	0	0	3
Apartments, rooming houses, tenements, hotels	21	17	13	14	44
Automobiles and trucks	11	14	1	0	15
Tank truck fires	1	2	0	0	2
House trailer fires	4	2	2	3	7
Barns	9	10	0	2	12
Chemical laboratories	1	1	0	0	1
Churches	2	1	1	0	2
Dwellings—rural	42	17	15	31	63
Dwellings—urban	74	21	34	47	102
Fire fighting	3	3	0	0	3
Garages	1	1	0	0	1
Hospitals	2	0	1	1	2
Manufacturing occupancies—miscellaneous	9	18	0	0	18
Mercantile occupancies—miscellaneous	5	5	1	0	6
Mining property fires	1	4	0	0	4
Oil refineries	1	1	0	0	1
Out of door fires	19	8	4	7	19
Prisons	2	4	0	0	4
Response to alarms	1	2	0	0	2
Restaurants	1	0	1	0	1
Schools	1	1	0	0	1
Totals	219	146	77	105	328

*This table is made up from those reports received by the Department of Fire Record between March 26, 1939, and June 23, 1939. Several of the fires included herein occurred prior to March 26, 1939, but were not reported until subsequent to that date.

Foreign Fires.

Nine fires, involving large losses of life, have been reported during this quarter from outside the United States and Canada. These figures are not included in the tables, but summaries of these fires are given below.

NOVEMBER 26, 1939, BATHURST, SOUTH AFRICA. Eleven persons were burned to death when a large German air liner struck a tree during the take-off and crashed at the airport. (L-5534.)

MARCH 31, 1939, BEIRUT, SYRIA. Seven workmen were killed by a fire which destroyed a part of the property of the National Oil Company. (L-5535.)

APRIL 5, 1939, OSLO, NORWAY. Six workmen were killed and several others injured by an explosion which occurred during repairs on board the S.S. *Katy*. It is reported that the explosion was caused by the welding of a tank containing benzene fumes. (H-43188.)

APRIL 12, 1939, LOWER EGYPT. A conflagration destroyed three villages, killing twenty-one persons and injuring sixty-three others. The fire started from a spark blown from an open oven on to the thatched roof of a native dwelling. (L-5536.)

APRIL 20, 1939, DAOURS, FRANCE. Five persons were asphyxiated when a motor train caught fire and was derailed. (L-5537.)

MAY 5, 1939, GUAYAQUIL, ECUADOR. At least eighteen persons lost their lives in a fire which resulted when a military airplane crashed in the down-

town section of the city. Fire spread rapidly from the exploding gasoline tanks and destroyed four buildings before it could be controlled. (H-43189.)

MAY 9, 1939, TOKYO, JAPAN. Ten persons were known to have been killed, and 300 injured, when two explosions occurred in a pyroxylin factory. The fire destroyed several near-by buildings. (L-5538.)

Causes of Loss of Life, April-June, 1939.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

Class of Fire	Men	Women	Children	Total
Airplane fires	11	4	0	15
Asphyxiation	6	5	5	16
Automobile or truck collisions and fires	13	1	0	14
Collision of train with tank truck	2	0	0	2
Children alone in house	0	0	7	7
Clothing ignited (other than following classifications)	3	3	3	9
Bonfires, rubbish fires	1	4	4	9
Burning gasoline	4	3	3	10
Falling into fire	3	0	0	3
Matches	1	0	6	7
Oil lamp	1	1	2	4
Oil stove or oil heater	2	6	1	9
Smoking (see also smoking in bed)	1	0	0	1
Stove	0	4	3	7
Electric heater and other electrical causes	1	1	0	2
Entering or re-entering a burning building	1	0	0	1
Escaping fires; jumped, fell or drowned	1	0	0	1
Explosions, miscellaneous	2	2	0	4
Chemicals	0	0	2	2
Dust	9	0	0	9
Fireworks	1	0	0	1
Illuminating gas	3	1	0	4
Fire fighting—firemen	5	0	0	5
Fire fighting—private individuals	3	0	0	3
Flammable liquids and vapors fires:				
Gasoline lanterns and stoves	3	2	1	6
Gasoline used for cleaning purposes	1	3	2	6
Gasoline used to start fire	3	3	3	9
Gasoline fires, not otherwise classified	0	1	0	1
Kerosene used to start a fire	3	10	7	20
Oil refinery fires	1	0	0	1
Tar ignited	1	0	0	1
Mine fires and explosions	4	0	0	4
Response to alarms (collisions)	2	0	0	2
Smoking in bed	6	0	0	6
Trapped in burning building	44	22	56	122
Indirect cause	4	1	0	5
Totals	146	77	105	328

JUNE 4, 1939, ZACATEPEC, MEXICO. Fire which broke out in a wooden motion picture theatre destroyed 200 homes and brought death to a large number of persons variously reported at from 25 to 80. This town, founded two years ago during a sugar boom, lacked any kind of fire fighting equipment. The fire is reported to have started at the projection machine. (H-43190.)

JUNE 13, 1939, TEHRI AND GARHWALL, INDIA. Fifty villagers were killed by a forest fire which devastated a wide area. (L-5539.)

Typical Loss of Life Fires.

Airplane Fires.

MAY 24, 1939, MARLETTE, MICH. An army airplane exploded and crashed near this city, killing the pilot. The cause of the explosion was undetermined. (H-43176.)

JUNE 15, 1939, JUNEAU, ALASKA. The pilot of a seaplane was burned to death after the plane struck a mooring buoy while taxiing over the water and burst into flames. The plane was laden with 265 gallons of gasoline in cases. The co-pilot made his escape by jumping and reported that either an explosion or falling gasoline cases prevented his companion from doing likewise. (H-43175.)

Automobile, Truck and Tank Truck Fires.

APRIL 27, 1939, NEAR HAVRE DE GRACE, MD. One man was burned to death and a second died in a hospital of burns when the automobile in which they were riding left the road, overturned and caught fire. (L-5211.)

MAY 6, 1939, FAYETTEVILLE, N. C. Two men were instantly killed and two others burned to death when a gasoline-transport truck and freight train collided. The fire ignited nine boxcars, four automobiles, and two houses. (H-43180.)

JUNE 1, 1939, EMPORIA, VA. Two men died and a third was seriously injured when two large trucks crashed head-on and immediately burst into flames. (H-43181.)

Children Alone in House.

MARCH 6, 1939, SAPULPA, OKLA. A small child and an infant were burned to death when fire destroyed their house while their parents were visiting neighbors. (L-5524.)

MARCH 29, 1939, BATH, ME. Two small children were burned to death when fire swept through their small home while their parents were absent. (L-5525.)

Clothing Ignited.

MARCH 26, 1939, BROCKTON, MASS. A two-year-old child was fatally burned when her clothes became ignited while she was playing with matches. (L-5508.)

APRIL 12, 1939, WEST SWANZEY, N. H. An elderly man died from burns received when his clothing caught fire as he was attempting to extinguish a brush fire. (L-5510.)

APRIL 24, 1939, FREDERICKBURG, VA. A man was fatally burned when gasoline he was pouring into an engine in operation ignited and set fire to his clothing. (L-5512.)

APRIL 29, 1939, BROOKLYN, N. Y. An aged woman suffered fatal burns when her clothing was ignited by a gas range. (L-5513.)

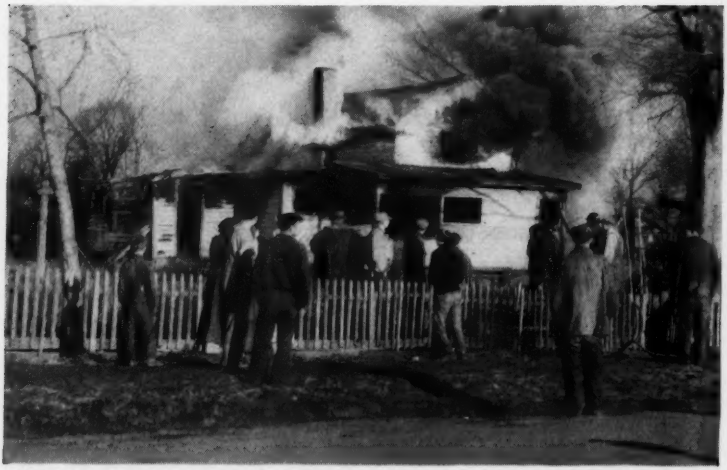
International.

As in other tenement fires, the outside balcony fire escapes proved a worthless substitute for properly enclosed stairways and exits when fire swept these "old law" tenements in New York's Chinatown. Eight Chinese were burned to death. Several lost their lives when trapped on the fire escape. (See page 85.)

MAY 25, 1939, BAKERSFIELD, CALIF. A young man was burned to death when the gasoline tank truck he was operating took fire while loading at a refinery. In making his escape from the cab of the truck, his clothing became ignited. Panic-stricken, the victim ran into a near-by warehouse, where oil and other lubricants were stored. These immediately took fire and damage estimated at $40,000 resulted. (H-43182.)

Explosions.

APRIL 19, 1939, PIOCHE, NEV. Four miners were killed and two others injured by an explosion, which occurred while the workers were passing blasting powder to men at the head of a horizontal shaft. (H-43185.)



Horror stricken neighbors gathered at this home as firemen fought the blaze which took the lives of a father and six children at Ottumwa, Iowa. Note the fire-trap construction, with low ceilings and small windows confining the heat and flames. (See page 85.)

MAY 14, 1939, EVANSTON, ILL. Two boys were killed and a third injured, when chemicals exploded during an experiment they were conducting in the basement of their home. (L-5516.)

MAY 26, 1939, EAST PATCHOGUE, N. Y. One man was killed and another seriously injured when an explosion completely demolished a fireworks factory. The cause of the explosion is unknown. (L-5517.)

Flammable Liquid Fires.

MARCH 7, 1939, MT. AYR, IOWA. Four children burned to death when fire destroyed their farm home. Their mother, who was also seriously burned, told rescuers the tragedy occurred when she poured kerosene into a range to start a fire. (L-5518.)

APRIL 1, 1939, WICHITA, KANSAS. Two small children were fatally burned and three other persons were severely injured when an explosion followed their father's attempt to speed a fire in the kitchen stove with gasoline. (L-5519.)

APRIL 15, 1939, MINNEAPOLIS, MINN. A twelve-year-old boy was fatally burned when gasoline, which he was using to clean his cap, ignited and set fire to his clothes. The source of ignition was not definitely determined, but it was believed that a water heater may have been responsible. (L-5521.)

MAY 6, 1939, PERTH AMBOY, N. J. A woman died of burns received when a fluid she was using for cleaning purposes ignited and set fire to her clothing. (L-5522.)

JUNE 18, 1939, GRANVILLE, N. Y. A man died of burns suffered when gasoline with which he was cleaning grease from his hands ignited. (L-5523.)